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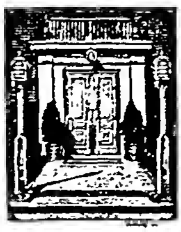
INFORMATION TOLD IN AN INTERESTING
STYLE, AND THUS LEAD INTO
BROADER FIELDS OF KNOWLEDGE,
SUCH IS THE PURPOSE OF
THIS WORK



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COMPTON'S PICTURED ENCYCLOPEDIA

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Here and There in This Volume

AT ODD TIMES when you are just looking for "something interesting to read," without any special plan in mind, this list will help you. With this as a guide, you may visit faraway countries, watch people at their work and play, meet famous persons of ancient and modern times, review history's most brilliant incidents, explore the marvels of nature and science, play games—in short, find whatever suits your fancy of the moment. This list is not intended to serve as a table of contents, an index, or a study guide. For these purposes consult the Fact-Index and the Reference-Outlines.

Pictures You Will Enjoy

For the Reading Hour

Parent and Child; School and Home

High Lights in History's Pageant

The Story of the Presidents

Some Famous Men and Women

Travel Views of Lands Across the Seas

The Story of the States

In the Plant and Animal World

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Exploring a World of Facts

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KEY TO PRONUNCIATION

Pronunciations have been indicated in the body of this work only for words which present special difficulties. For the pronunciation of other words, consult the Fact-Index. Marked letters are sounded as in the following words: cāpe, ăt, fär, fȧst, what, fall; mē, yĕt, fẽrn, thêre; īce, bĭt; rōw, wȯn, fôr, nŏt, do; cūre, bŭt, rude, full, bûrn; *out*; ü=French *u*, German *ü*; ġem, ḡo; *th*in, *th*en; ṅ=French nasal (Jeaṅ); *zh*=French *j* (*z* in azure); ᴋ=German guttural *ch*.

I

IBERVILLE, Pierre le Moyne, Sieur d' (1661–1706). In Colonial days a daring French-Canadian spent his life trying to win America for France. He was Pierre Iberville. His bold military victories over the British in Canada did not gain much land. But his skill as a colonizer strengthened France's claim to all the "Louisiana country," for he founded the first French colony near the Mississippi River on the Gulf of Mexico.

Iberville has been called the "first great Canadian." He was born in Montreal, July 16, 1661. He had ten brothers and three sisters. His father, Sieur Charles le Moyne, taught his sons Indian lore and frontier skills. Pierre became expert at hunting and canoeing. When he was only 12 his father took him with Governor Frontenac's party into the wilderness to treat with the Iroquois. At 14 Pierre was commissioned in the royal navy. After some years of service he returned to Canada, eager to help drive the British from America.

Iberville was 25 when the undeclared war against the British fur trade began. He quickly joined a band of French-Canadian adventurers under Sieur de Troyes. After a trek of 900 miles on snowshoes and in canoes, they raided James Bay, and Iberville helped to capture three forts of the Hudson's Bay Company. In 1689, war was officially declared (*see* King William's War). Iberville led three more daring attacks against British posts in the Far North. He also directed the destruction of Schenectady in New York and seized St. John's, Newfoundland. In 1693, he married Marie Therese Pollet de la Comte Pocatiere. They had two children.

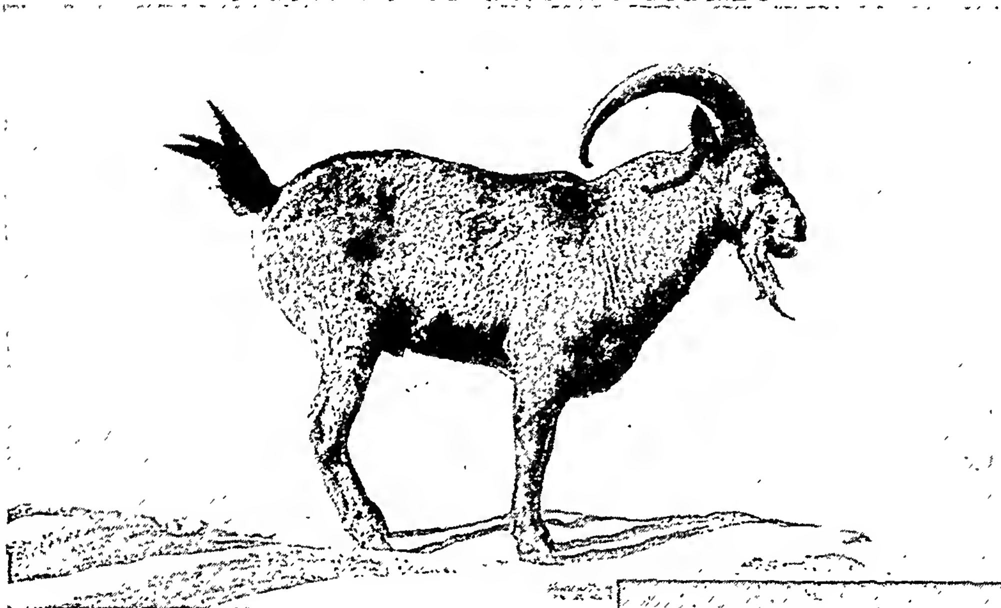
Iberville's greatest military exploit took place on Hudson Bay in 1697. His small fighting ship, the *Pelican*, met three British warships. He sank one and captured two. Then the *Pelican* was wrecked in a storm. But Iberville with his half-frozen crew captured the British stronghold, Fort Nelson.

After the war, Iberville was commissioned to locate the mouth of the Mississippi and to establish a colony. In 1699, after exploring the lower stream, he set up a colony at what is now Biloxi, Miss. This became France's foothold in the "Louisiana country." A year later he built a post near present-day New Orleans. When war began again in 1702, Iberville commanded the French West Indian fleet, and captured the islands of Nevis and St. Christopher in 1706. A few months later, he died of yellow fever in Havana, Cuba.

IBEX. The home of the wild goat called the ibex is in the most rugged and most inaccessible heights of the Alps and Pyrenees and the mountains of Asia and Arabia. It lives above the line of perpetual snow, only descending to graze at night in the highest forests.

The Alpine ibex, also called steinbok, was

A FAMILY OF ASIATIC IBEXES



The male ibex (top) has a beard and splendid curving horns. He lives with the female during the winter mating season. The kid (bottom) can follow its mother up steep mountain sides from birth.

once threatened with extinction as a result of overhunting. It has become re-established in the Alps, largely through the efforts of the Swiss League for the Protection of Nature. Laws forbid hunting it. The Asiatic ibex is still abundant.

The ibex stands about 40 inches high at the shoulders and is about 4½ feet long. The splendid horns of the male are 30 inches long in the Alpine species and may be 60 inches long in the Asiatic animals. They rise from the crest of the skull in a long, graceful backward sweep. On the front they are marked with bold cross ridges. The forelegs are shorter than the hind legs. This makes it easy for the animal to climb up steep slopes. The hair is ashy gray in the summer. In the bitterly cold winter of the high mountains the coat grows heavier, and long yellowish brown hairs cover the gray undercoat.

Ibexes feed in separate herds of males, and females with their young. The older animals usually live alone and at higher levels. Each herd posts a sentinel which watches for danger. The sudden upward leap of this sentry sends the entire herd in headlong flight up the mountain side. In late fall the animals pair off. Then the great horns of the males are put to use as they battle for the females. The mates remain together through the winter, until the single young is born in the spring, 90 days after breeding.

The scientific name of the Alpine ibex is *Capra ibex;* of the Asiatic ibex, *Capra sibirica;* of the Arabian ibex, *Capra sinaitica.*

Ibis and Spoonbill. Like a storm of great snowflakes, the white ibises circle over a Florida swamp, settle down on the water lettuce and violet hyacinths, and then spout suddenly upward again as though a gust of wind had seized them. Occasionally in the midst of this great white swirl a few of the rare rose-pink spoonbills may be seen.

Ibises and spoonbills are closely related tropical wading birds. They live in colonies along bays and salt-water lagoons of southern seacoasts and on interior marshes, where they feed on crustaceans, frogs, and small fish. Both birds stalk about the swamp with an air of haughty dignity. While resting, either on land or in a tree, they stand on one leg for an hour or more at a time. Like the cranes, they fly with neck and long legs outstretched. The spoonbill's flight is an easy, uninterrupted flapping. The ibis alternates the wing strokes with short glides.

The spoonbill gets its name from its large, flat, spoon-shaped bill. When it feeds, it submerges its bill and with mandibles open to scoop in whatever may come its way, swings the entire head and body from side to side as it moves forward, like a man mowing grain with a scythe. The roseate spoonbill, found in Florida and on the Gulf coast, is the only one of six species of spoonbills in America. This bird is almost three feet long. The wings and under parts are a delicate rose-pink, tipped with rich crimson. The plumes at the base of the neck are crimson, the upper neck and back are white. The nest is a bulky platform of sticks in small trees. The three to five eggs are white, blotched with olive-brown.

KNOW THEM BY THEIR BEAKS

The white ibis (top) probes in the sand for its food with its long pointed bill. The roseate spoonbill (bottom) uses its spoon-shaped bill as a scoop.

The ibis has a long, slender, downward curving bill with which it probes in the mud for food. It makes its nest of rushes and weed stalks, attaching it to reeds and low bushes. About thirty species of ibis are distributed over the warm parts of the earth. Four species occur in North America. The most abundant is the white ibis. As many as 35,000 individuals have been counted in a single Florida rookery. The adult bird is about two feet long. Its plumage is purest white, with glossy black wing tips. The face, bill, and legs are red. Immature birds are a dull grayish brown with white head and neck and white under parts. The sexes look alike. The birds nest across the southern United States from Florida to California. They have also been found as far north as the marshes of Long Island, southern Illinois, and Great Salt Lake.

Much less common are the eastern glossy ibis and the white-faced glossy ibis of the western states. They are dark-colored birds of a rich purple-green, with dusky bill and legs. The scarlet ibis of tropical South America has been recorded as an accidental straggler in the Gulf states. The sacred ibis of Egypt inhabits the Nile Valley. It was revered by the ancient Egyptians, who embalmed it at its death. Their superstitious awe may have arisen from the fact that the bird always arrives from the south at the time the Nile floods its valley—that is, the beginning of the season of abundance.

The North American ibises are sometimes called curlews, but the true curlews, although their bills are similar, are *short-legged* waders. The so-called wood ibis is a stork (*see* Stork).

Ibises and spoonbills form the family *Threskiornithidae*. Scientific name of the white ibis, *Guara alba;* eastern glossy ibis, *Plegadis falcinellus;* white-faced glossy ibis, *Plegadis guarauna;* scarlet ibis, *Guara rubra;* sacred ibis, *Ibis aethiopica;* roseate spoonbill, *Ajaia ajaja.*

IBSEN, HENRIK (1828–1906). Although the plays of Henrik Ibsen are limited almost completely to Norwegian themes, they have a universal appeal; and they have had a tremendous influence on later dramatists. Ibsen was a stern and lonely figure, who saw more evil than good in life. His pessimism no doubt sprang in part from the hardships and disappointments he experienced in his youth.

HENRIK IBSEN

Born in a poor family at Skien in southern Norway, he was apprenticed to an apothecary at Grimstad while still a boy. Seven years of drudgery followed. At the age of 19 he began to write poetry and at 22 he had written a tragedy in blank verse. He entered the University of Christiania; but he did not have money enough to complete his studies. Thereafter he did poorly paid newspaper work, managed a small theater, traveled in Denmark and Germany to study scenic art, and wrote lyrics and unsuccessful plays.

Finally He Wins Success

Ibsen was long in discovering his true bent, and he waited still longer for recognition. His 'Vikings at Helgeland', which marked an epoch in Norwegian literature, and 'Love's Comedy', the first of his social satires, were coldly received. In bitterness of spirit he left Norway. Two years later, in 1866, he flung back from Rome his splendid poetic drama 'Brand', and aroused his native country to tardy acknowledgment of his genius. The Norwegian parliament granted him a pension and asked him to come home, but until 1892 he chose to live abroad.

Success won, he devoted himself to writing satiric comedies of modern social life. Misfortune had developed in him a biting irony; and his plays were so bold, pessimistic, and scornful of social hypocrisy that they could not be ignored. When he was denounced as "immoral," his reply was the epigram he put in the mouth of one of his characters: "A minority may be right, a majority is always wrong." His recognition was greater abroad than in his native land. Some thought of him as a teacher, like Tolstoy, but Ibsen insisted that his plays had no moral purpose. He was simply a commentator, he said, prescribing no remedies for social evils.

In time it was recognized that his chief claim to distinction was as a playwright. His plots are masterly, his dramatic sense unerring, his dialogue lifelike. He scorned the "happy ending," and restored to the sentimentalized drama of the age something of Greek simplicity and logic. His plays have been translated into many languages. It is not too much to say that he revolutionized the drama of Europe and America (*see* Drama).

Ibsen's best-known works are 'Brand' (1866); 'Peer Gynt' (1867); 'The Pillars of Society' (1877); 'A Doll's House' (1879); 'Ghosts' (1881); 'An Enemy of the People' (1882); 'The Wild Duck' (1884); 'Rosmersholm' (1886); 'The Lady from the Sea' (1888); and 'The Master Builder' (1892).

ICE. When water becomes cold enough, bits of it freeze into six-sided, needle-like crystals called *frazil.* These increase and interlace until they form solid ice in which the closely packed crystals can no longer be seen as separate bodies.

Because water expands as it freezes, ice is lighter than water and rises to the surface (a cubic foot of ice weighs 56 pounds; a cubic foot of fresh water about 62 pounds). On ponds, rivers, and lakes it tends to prevent the water below from freezing, and there fish and other water creatures can keep alive during the winter.

Occasionally at the bottom of ponds or rivers, stones or other objects become so much colder than the surrounding water that ice forms upon them in spongy masses called *sponge ice* or *anchor ice.*

When water vapor in the air freezes it usually forms the light fluffy crystals we call snow (*see* Snow). At high altitudes it may turn into microscopic particles of solid ice which make up the cirrus type of cloud (*see* Clouds). Hail is simply snow crystals partly melted and frozen again (*see* Hail).

Like all crystals those of snow and ice have difficulty in forming without some tiny solid particle for a nucleus, such as a grain of dust. Hence in absolutely clean air, water vapor may be chilled below the freezing point (*supercooled*) without turning into ice. An airplane entering supercooled air provides a basis for the formation of ice which gathers very suddenly on the wings and control surfaces and may force the plane down.

Water vapor suddenly congealing on trees, vines, and fences may pile up in heavy masses called *glaze ice.* "Ice storms" of this sort can cause heavy damage to property. (*See also* Freezing; Water.)

WHEN *the* ICE CAME DOWN *from the* NORTH

ICE AGE. The people who may have been living in central North America 20,000 years ago saw ice and snow the year round. The men hunted along the edge of a great wall of ice that extended across the continent from ocean to ocean. In summer the women fished in chill streams that flowed from the melting ice. Anyone who ventured to climb the wall saw ice extending northward without a break.

These people were living in the grip of the latest Ice Age, a period when all of Canada, much of the United States, and most of northwestern Europe lay buried beneath sheets of ice hundreds or even thousands of feet thick. But these people did not live in bitter cold. The average temperature was only 10° or 12° F. lower than it is today along the border between the United States and Canada. Moreover, this cooler average and the very Ice Age itself were caused largely by cool summers rather than by bitter winters. There was not enough heat in the warm months to melt away the previous winter's snow and ice. So they piled up year after year, until they covered the northern country.

The biggest difference between the country near the edge of the ice sheet and the same country today was in the vegetation and animal life. The cold prevented the growth of trees, grasses, and most flowering plants. The ground was covered with mosses and lichens, and in the warmest weeks a few fast-blooming plants sprang up such as we find in the Arctic today (*see* Arctic Regions). The principal animals were reindeer, or caribou, musk oxen, and mammoths, which could paw through snow to get food; and meat eaters, such as bears and wolves.

A REMNANT OF THE ICE AGE

This ice cave in a glacier high up on Mount Rainier, Washington, provides an excellent illustration of what happened on a much vaster scale at the wane of the Ice Age. The glacier, melting away about 70 feet a year, feeds a subglacial stream. Warm air entering above the stream hollows out a cave, and the clay and rocks embedded in the ice drop down in heaps.

Today, the geologists say, we are just reaching the end of this Ice Age. Inhabitants of Greenland still live at the edge of an ice wall, and explorers have traveled across that island, some 800 miles, on a solid sheet of ice 8,000 feet thick in some places.

Ice-filled valleys are still fairly common in high mountain ranges. These are called *valley glaciers* and cover small areas. The sheets of ice that cover great areas are called *continental glaciers* or more simply *ice caps* (*see* Glacier).

Why Scientists Believe in an Ice Age

Why do scientists believe that ice once covered so much of North America? The answer begins with Louis Agassiz, who was born in 1807 in Switzerland (*see* Agassiz, Jean Louis). Agassiz became a teacher of natural science, and he knew much about the glaciers of his native Alps. He observed how they rubbed the valley floors and sides, carried rocks, and left mounds of gravel as they melted. He noticed also that boulders of granite could be found hundreds of miles from any solid granite formations. Finally, bedrock far from the Alps showed grooves and scratches (called *striae*, from the Latin for "furrows"), such as would be made if glaciers had pushed smaller rocks over it. But if the glaciers had been big enough to do this, they must have covered most of northern Europe.

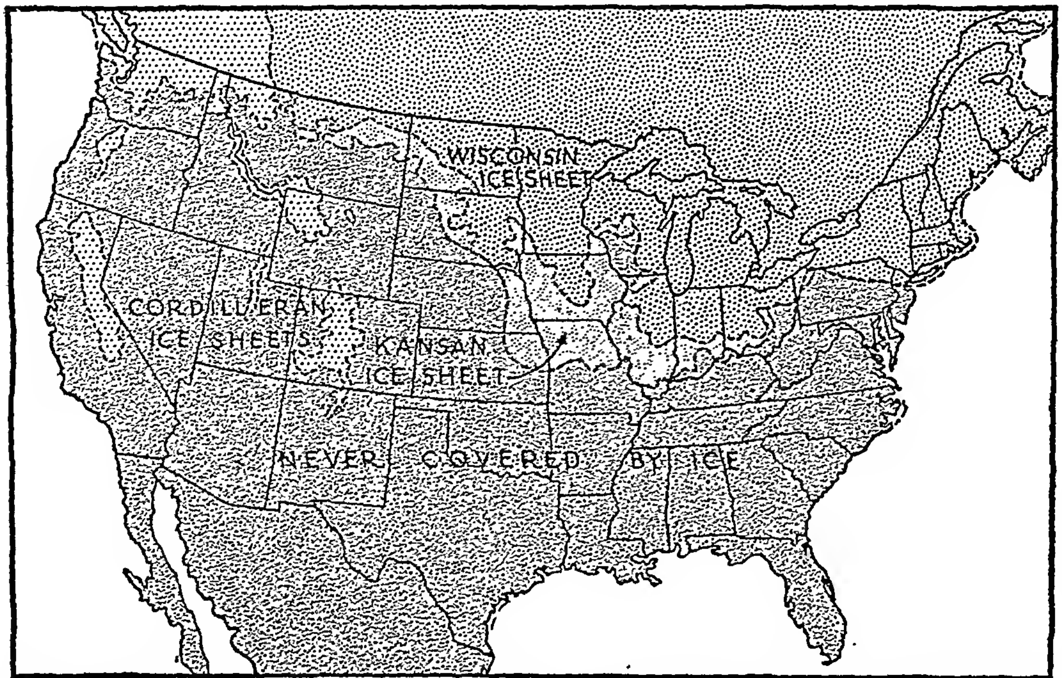
Other Traces of the Ice Age

Geologists still use modern glaciers as a guide in studying the old Ice Age. These illustrate how the unmelted snow piled up and how the flakes changed to sand-like grains near the surface and to ice below. When the ice became about 150 feet thick, it began to push out at the edges. The creeping ice rubbed away small hills, and carried the gravel, sand, and clay that came from them into the valleys. These deposits are called *glacial till.* Streams from the melting edges of the glaciers scattered sand and gravel in long, crooked mounds called *eskers.* Drifts that piled up under the ice now appear as low hills called *drumlins.*

During this flow the ice carried boulders and soil southward until it reached a climate warm enough to melt it completely each summer. As it melted, it dropped its burden upon a sort of rubbish heap, called a *moraine*, along the line of melting. When warmer summers drove the line of melting northward, the moraines were left. Today we see them as broad, gently sloping mounds across the landscape.

Wherever the ice retreated, the water from the melting edge had to find new channels, for the old river valleys were filled with drift. Much of the flow was caught behind the moraines and the waters spread out to form lakes. As the levels of these lakes rose they overflowed at low places and often joined one another in long chains connected by small streams. A glance at any map of the northern United States and southern Canada will show this wealth of connected lakes and streams. The lakes range in size from small forest pools to the Great Lakes (*see* Great Lakes).

ICE AGE BOUNDARIES IN THE UNITED STATES



The dotted and the light gray areas are those that were covered by thick ice sheets in the distant past. The Kansan sheet overlapped most of the area reached by the earlier Nebraskan sheet; and the latest, named the Wisconsin sheet, covered about the same territory as the Illinoisan. In the high altitudes of the west we see the outposts of the Cordilleran ice sheet. Notice the "island" at the junction of the states of Wisconsin, Illinois, and Iowa that was never entirely covered by the ice.

As geologists studied this sort of evidence throughout the world, they decided that Agassiz's simple "Ice Age" really consisted of four periods; that is, the ice formed and advanced, then melted back toward the poles, four different times. They believe this because they find moraines and other deposits from each period, and in places these lie one over another, so that the younger can be distinguished from the older. In the United States, each of the four cold periods, called *glaciations*, is named for a state that was reached by its ice, as shown in the accompanying table. The intervening warm periods, called *interglacial* phases, are named for localities where relics from them were studied. In Europe, the glacial phases are named for the little Alpine river where they were studied and the interglacial periods are indicated by hyphenating the names of the glacial periods that preceded and followed.

	In America	In Europe
First Glaciation	Nebraskan	Günz
Warmer Period	*Aftonian*	*Günz-Mindel*
Second Glaciation	Kansan	Mindel
Warmer Period	*Yarmouth*	*Mindel-Riss*
Third Glaciation	Illinoisan	Riss
Warmer Period	*Sangamon*	*Riss-Würm*
Fourth Glaciation	Wisconsin	Würm
Warmer Period	*Modern or Post-glacial*	*Modern or Post-Würm*

From the direction of the grooves or striae in the bedrock, it has been established that in North America the ice always spread out from the same three centers or ice caps. These were named after the regions they covered: Labrador, Keewatin, and Cordilleran, as shown in the map on the next page. The thicknesses of the ice sheets in various places were measured by the height of the striae on mountain sides.

Many types of animals that formerly inhabited North America were driven out or destroyed by the successive invasions of ice. Among them were the huge elephant-like mastodon, the saber-toothed tiger, members of the camel and llama family, and several species of horses.

Patient study has helped geologists to estimate how long ago each of the four ice sheets covered North America and Europe. In general it seems that the Nebraskan ice sheet covered North America perhaps 2,000,000 years ago, the Kansan sheet 1,250,000 years ago,the Illinoisan sheet 500,000 years ago, the Wisconsin sheet 100,000 years ago. The warm period called the *Yarmouth*, between the Kansan and the Illinoisan glaciations, lasted much longer than any other period, warm or cold.

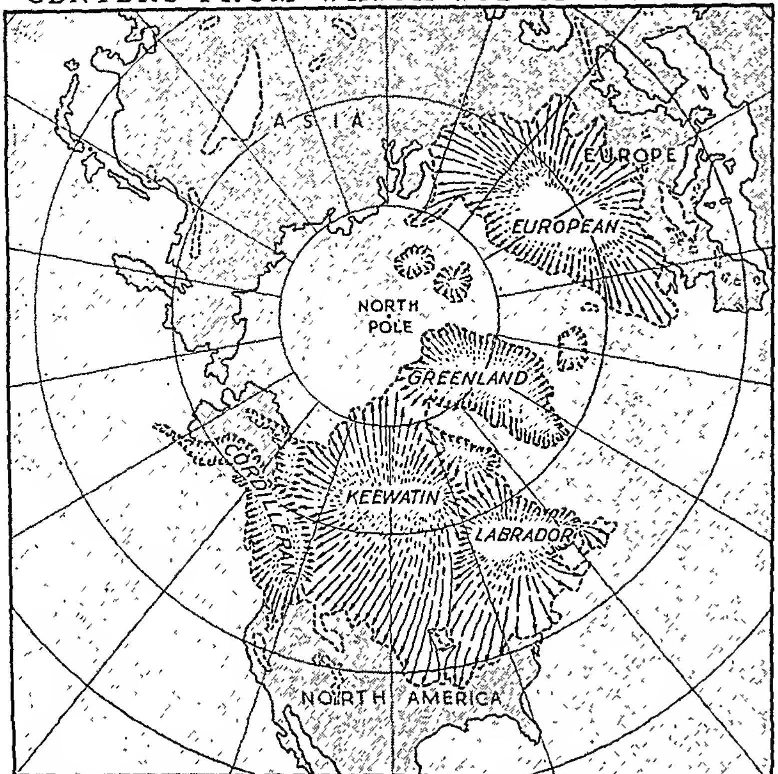
The latest, or Wisconsin, sheet probably began to melt at its edges about 40,000 years ago. The ice cap centered over Labrador drew back from the Niagara Falls region about 36,000 years ago and left New England clear about 28,000 years ago. The Keewatin ice cap, longer and thicker, did not leave Minnesota until about 15,000 years ago. Europe's ice blanket melted from central Germany 17,000 years ago, and from Sweden 13,000 years ago.

How the Ice Age Has Affected Modern Life

The immense amount of glacial drift inherited from the Ice Age has influenced the character of soil wherever it was laid down and has played an important part in the development of agriculture (*see* Soil).

Other changes were caused by the tremendous weight of the ice sheet. It was about two miles thick over much of North America. This placed 400 tons or more upon every square foot of surface. The earth's crust sank under this load—from 300 to 800 feet in areas like New England. Here the land has not yet risen to its former level, and many ancient valleys are now under the sea, forming bays and inlets. Chile and Norway present other "drowned coasts," with many fiords filling valleys which old glaciers gouged out.

CENTERS FROM WHICH ICE SPREAD OUT



The map shows five great ice caps from which the ice moved outward during the Ice Age and to which it retreated later. Three of these are in North America.

where they left stone relics of many kinds (*see* Man).

Evidence of Earlier Ice Ages

The latest Ice Age, with its four phases, is by no means the only one in the earth's long history, according to geologists. They believe that two Ice Ages occurred, one in eastern Canada, and another in China, South Africa, Norway, and North America, during Proterozoic times, when the earth was young (*see* Geology). During the Paleozoic era, the Coal Age with its luxurious swamp growth seems to have been closed by the most severe ice age the world has ever known. Even tropical lands in India and Africa show evidence of ice sheets. South America may have been ice-capped from the Brazilian jungles southward.

Causes Are Mysterious

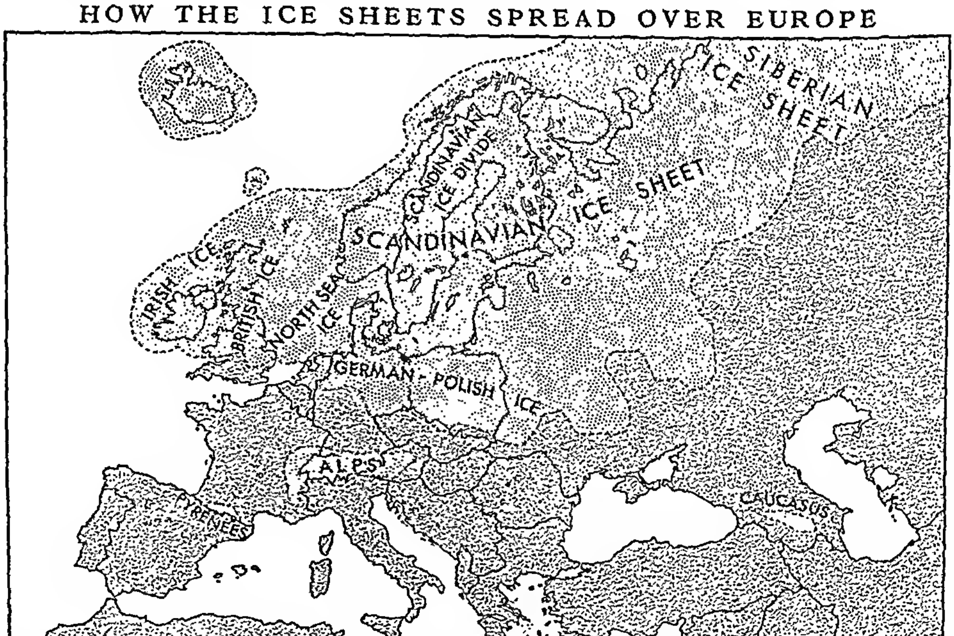
Ice ages arrive, as we have seen, when the climate over a region becomes cooler, and summer heat fails to melt away winter ice and snow. But why should summers have become cooler at different times in the earth's history?

Some scientists have tried to explain this by variations in the movement of the earth around the sun. But no variation has ever been found which fits both the theories of astronomy and the record of what has happened on the earth. Others have guessed that blankets of dust or of carbon dioxide got into the air and cut off part of the sun's heat. The newest

The estimated 12 million square miles of thick ice sheets were formed, of course, of water drawn from the oceans. This lowered the oceans several hundred feet below their present level, all around the world. Old, low shore lines have been found by sounding beneath the sea off the Hawaiian Islands, Bermuda, and elsewhere. A huge amount of water still remains locked in ice over Antarctica and Greenland. If this should melt, it would raise the oceans another 50 feet.

Scientists tell us men moved southward and northward, as the ice sheets advanced and melted back. In Colorado and near by, flint arrowheads have been found embedded in the bones of mammoths and other Ice Age animals, now extinct. During the last cold period in Europe, men lived in caves

HOW THE ICE SHEETS SPREAD OVER EUROPE



Europe, like North America, had four periods of glaciation. The successive ice caps reached different limits; but the differences were not great. The area covered by ice at any time is shown above.

theory was advanced in the early 1930's by a British meteorologist, Sir George C. Simpson. He suggested that the sun may have become cooler and warmer at various times, as some stars are known to do. But this theory shifts the question from the earth to the sun. Why should the sun's heat have varied in this way?

"Calendars" in Clay

A most important help in studying ice ages rests on a discovery made by Baron Gerard de Geer of Sweden when he learned how to estimate time from soil deposits on the bottoms of old glacier-fed lakes. These deposits were left by the outflow of water from the melting ice, and they differed with the seasons. Coarser sand settled in the summer when there was much melting and strong currents. This sand in turn was covered by thinner layers of fine clay deposited in winter from the quiet, ice-covered waters. De Geer called each combination of summer and winter deposits a *varve* —Swedish for "layer." Thus each varve represented one year of sediment.

VARVES

Here is a sample of varves obtained from a deposit in New Jersey. The dark and light bands laid down in summer and winter show clearly. A warm year caused more melting and made thicker layers (*a*) than did a cool year (*b*).

Varves differed from year to year, being thick in moist years and thin in drier ones. Wet and dry years tend to run in groups, and the varves in all the lakes of a region show a corresponding pattern. This made possible a year-by-year count of time from lake bed to lake bed as the ice cap melted back. As more southerly lakes dried up, distinctive "year-to-year" patterns would be left near the top of the deposit. Farther north, these patterns would be found near the bottom of a new lake. There the count of the years could be carried forward and could then move north again from lake to lake until the whole retreat of the ice was dated.

Baron de Geer and his pupils made reasonably complete counts in Europe, and one pupil, Ernst Antevs, made a similar count in North America, from Long Island Sound to Hudson Bay. Their figures helped to give dates for the latest glaciation.

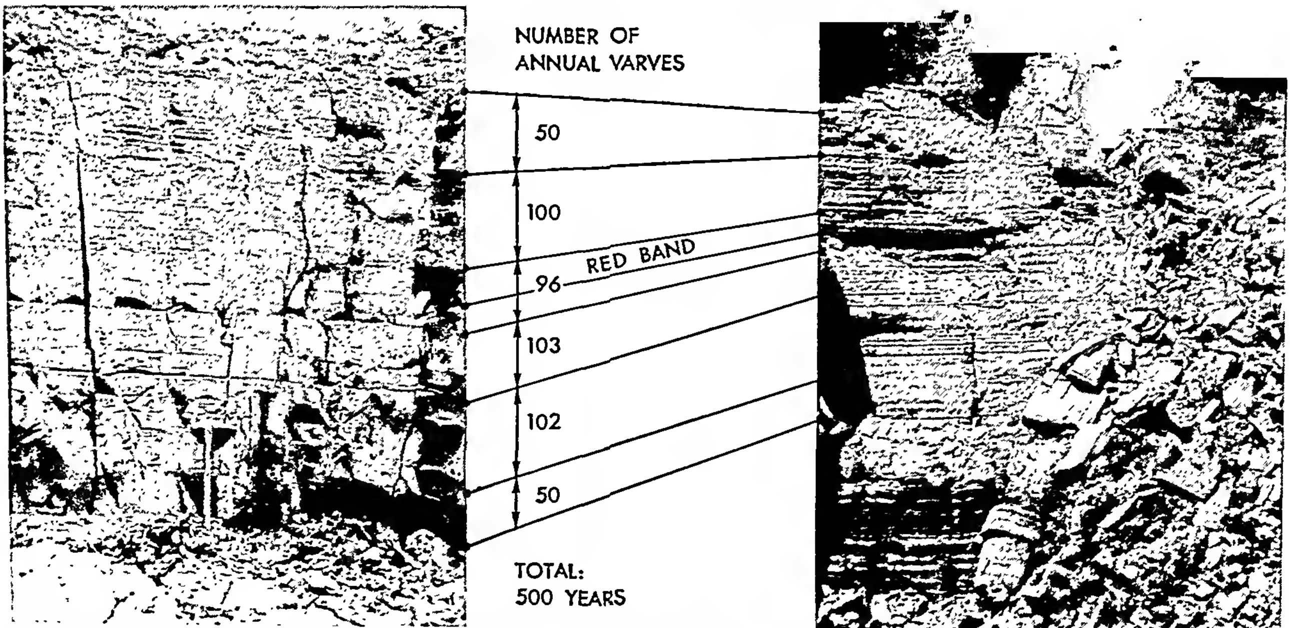
End of the Ice Age

De Geer estimated that the Ice Age ended when the ice melted from a fork in the upper Angerman River in northern Sweden. By this time, modern climate was established over most of Europe. He (and after him, his daughter) carried the count on through later centuries until in 1933 it could be matched with known dates in history.

By this means De Geer's end of the Ice Age was dated as occurring in 6740 B.C., with an uncertainty of only a few hundred years. Antevs obtained comparable results in North America. Many details of this count have been questioned. But scientists accept the span of time involved as reasonably accurate.

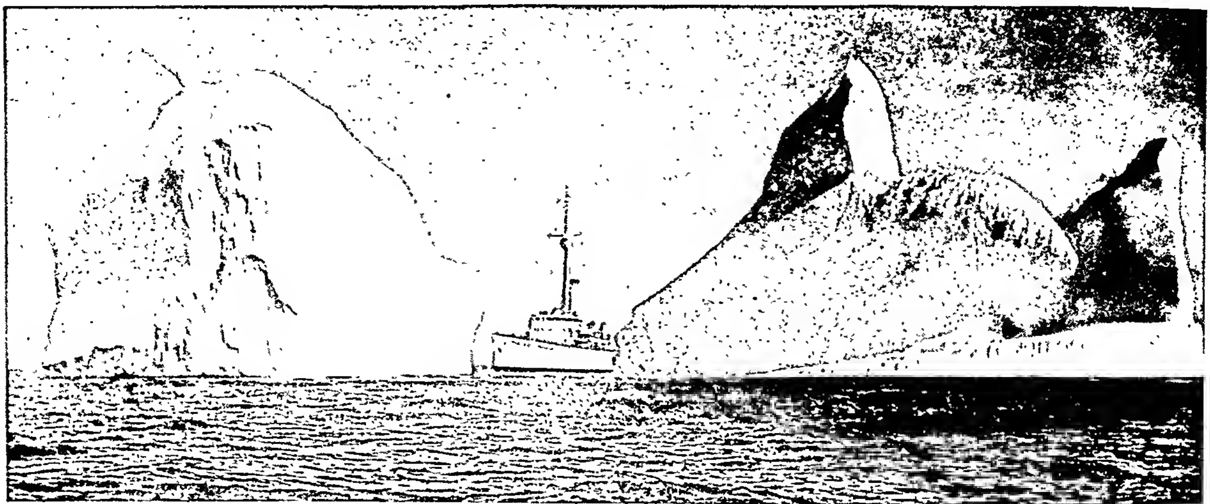
Study of natural features caused by the Ice Age glaciers makes a fine hobby for anyone who lives in an area once covered by the ice. In such regions great boulders set down by the retreating ice are common. Sharp eyes can also recognize the peculiar long moraines and rounded drumlins left by the ice, as well as glacier-smoothed valleys.

HOW VARVES ARE MATCHED TO ESTABLISH A CALENDAR



A succession of wet and dry years leaves a distinctive array of thick and thin varves in clay deposits. These can be compared from one place to another. Each deposit has the same succession covering 500 years. A peculiar red band in each deposit helps in matching them exactly. If this band had existed near the *top* of one deposit (end of melting) and the *bottom* of another (start of melting), the count of years each way from the band could be added to help establish a year-by-year record of the Ice Age.

A COASTGUARD CUTTER ON ICEBERG PATROL



From its gigantic bulk beneath the water, this iceberg thrusts two jagged peaks above the surface. In a short while, it will probably split down the middle. The patrol boat will then warn ships that there are two bergs to watch for instead of one.

ICEBERGS. Floating icebergs are at once the dread of sailors and the wonder of all who see them for the first time. They are the broken-off ends of glaciers that slide into the sea. They vary in size from small, flat "growlers" to mountains of ice a mile or more across and more than 200 feet above the water.

The part below water is about seven times as large as the part above. This is because the iceberg is made of fresh-water ice, weighing about seven eighths as much as sea water. In fresh water the iceberg would sink down until about nine tenths was below the surface (*see* Ice). The underwater part of an iceberg may extend far to one side of the visible part, so a ship that sails close may strike it. This happened to the steamship *Titanic*, which went down near Newfoundland April 14, 1912, with a loss of nearly 1,600 lives.

AN ICEBERG'S UNDERWATER SHELF

This air view shows how an iceberg's underwater tongue may project beyond the visible portion and rake a ship that sails too close. Men are landing on the berg from a Coast Guard boat.

When these wanderers of the sea are free from the fog that so often surrounds them, they shimmer in the sun with dazzling beauty, reflecting the tints of sea and sky. As they drift, many assume fantastic shapes —such as castles, arches, or domed mosques. At night the bergs glow with a peculiar whiteness called "ice blink," caused by the reflection from the crystal surface of feeble light rays.

New icebergs are being formed constantly. Most of those in the north Atlantic break off from the continually advancing fringes of Greenland's great icecap. Here in the early spring thaws, great processions of floating ice islands begin their journey southward. Sometime in April, May, or June an average of 400 reach the northern Atlantic steamer routes.

When afloat, icebergs melt rapidly in the salt water. High waves and heavy swells hasten their destruction. As they dissolve they may split in two, roll over, or slough off great fragments with a gigantic roar. Some bergs, however, are so huge that they travel 2,000 miles or more before disappearing.

Two routes are particularly dangerous: one through the Strait of Belle Isle into the Gulf of St. Lawrence; the other along the Grand Banks. Since 1914 vessels of the United States Coast Guard have conducted the international service of ice observation and ice patrol in the North Atlantic. The service is financed by the maritime nations. Reports of the positions and movements of icebergs encountered are broadcast by radio. The Hydrographic Office also issues bulletins charting the iceberg region and pilot's charts showing safe "tracks" across the ocean for shipping in each season (*see* Navigation). The Coast Guard equips its cutters and planes with radar and loran to fix the location of icebergs. In addition, underwater sound equipment and sensitive instruments that register variations of 1/10,000 of a degree in temperature help to locate bergs. (*See also* Glacier.)

ICE CREAM. The people of the United States eat about $6\frac{1}{2}$ million quarts of ice cream a day. To supply this vast amount, modern ice-cream plants in every community use elaborate equipment.

Cream, milk, milk concentrates, and sweetening are the chief ingredients of ice cream. A small amount of some colloid, or "stabilizer," such as gelatin, prevents the formation of ice crystals. To these ingredients are added flavoring and coloring matter.

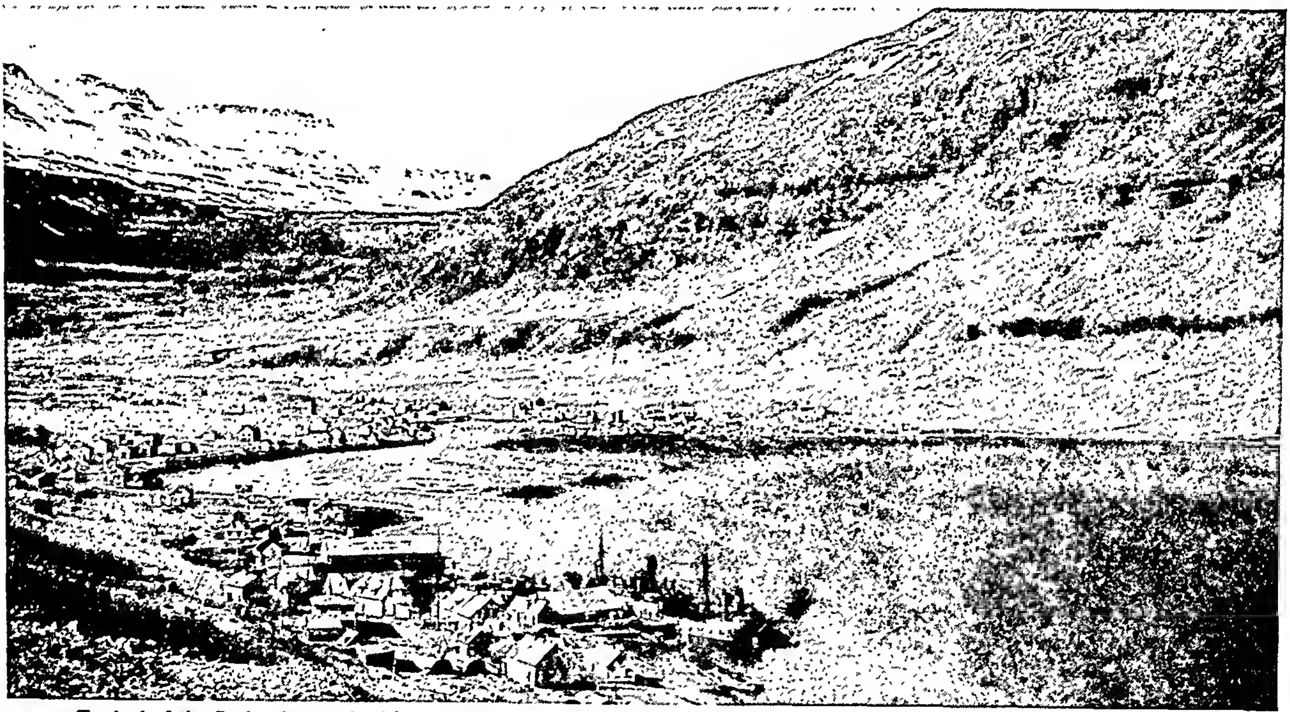
The principal ingredients are first mixed and pasteurized. The mixture is homogenized to break up the butterfat and then goes to the freezers (*see* Milk). As the mix is frozen, air is whipped into it to make it light and creamy. This nearly doubles its volume, and the increase is called the "overrun." Fruits or nuts may be added during or after freezing. When half frozen, the mixture is put into containers and hardened. A popular product, *soft ice cream,* is sold as drawn from the freezer without hardening. *Frozen custard* contains eggs in addition to the ingredients mentioned and is cooked to a custard before freezing.

Ice cream contains the vitamins and minerals of milk. The grade or quality is regulated by law and depends upon the amounts of butterfat, of other food solids, of stabilizer, and of overrun. According to Food and Drug Administration standards, ice cream should contain 12 per cent butterfat; *ice milk* has about 4 per cent butterfat; *sherbet* contains fruit juices, milk, sugar, and stabilizer with a butterfat content of no more than 2 per cent; and *ices* are made of fruit juices, sugar, and stabilizer, without milk.

Since the second World War a variety of frozen desserts, using milk with vegetable fats (cottonseed and soybean oils) instead of butterfat, have appeared on the market. They sell at a lower price than ice cream and have enjoyed a large sale in the states that permit their manufacture. Organizations of dairy farmers have sought laws against these "imitation ice creams."

The origin of ice cream is not known. Credit for first freezing fruit waters is usually given to an Italian named Procopio Cultelli, who kept a café in Paris in 1600. By 1780 both ices and ice creams could be purchased in Europe and in the United States. In 1851 Jacob Fussel, of Baltimore, first manufactured ice cream on a large scale.

ICELAND'S *Bleak* LAND *and Democratic* PEOPLE



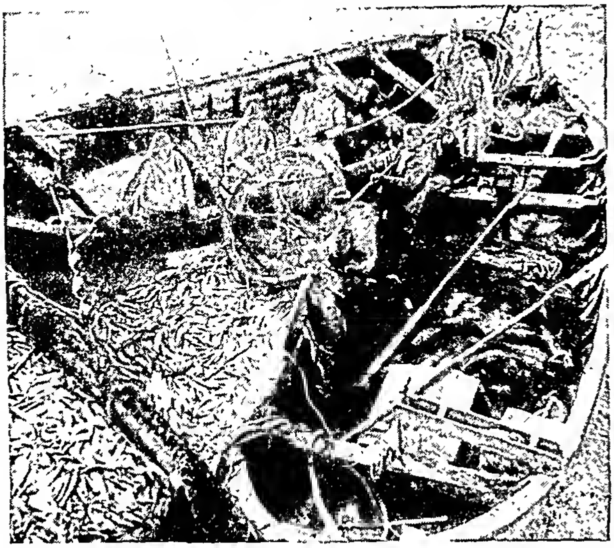
Typical of the Iceland coast is this cove, or fiord, with its rim of snow-clad mountains and its lonely fishing village. Its people turn to the sea for a livelihood because farmland is scarce.

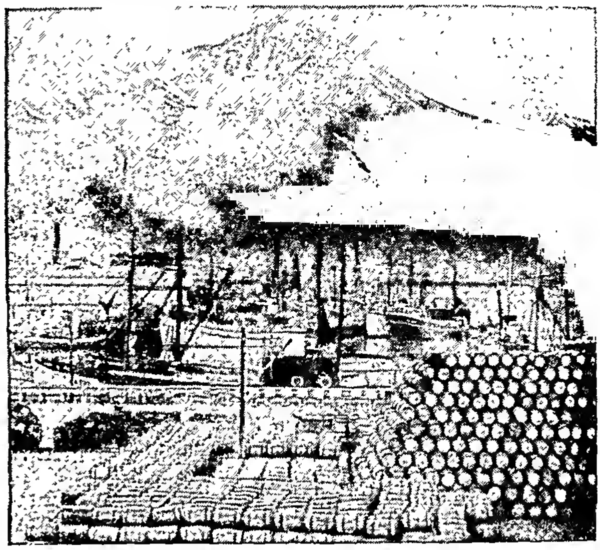
ICELAND. The story of Iceland is a bright chapter in the history of civilization. This remote island in the North Atlantic has the oldest of all existing parliaments. The Icelanders created it in the year 930, and it quickly adopted a code of laws. Its upper house had judicial powers, and Iceland had the first jury system. Within the next century, the Icelanders took another advanced step, creating mutual insurance against loss of property.

In no country is the general level of education higher or is there a more widespread love of good literature. Crime is all but unknown, and Iceland's co-operative societies and liberal social-insurance laws are models.

Visitors marvel at the achievements of this handful of people—only 144,263 (1950 census, preliminary) —when they see the bleak "island of ice and fire." It thrusts up from the sea about 180 miles east of

FISHING FOR HERRING ALONG THE NORTH COAST





During the midsummer herring run, the fish come to north Iceland waters by the millions. Here fishermen in small boats are unloading a huge netful into the mother ship with which they work. At Siglufjördhur, the principal herring port, we see the fishing boats in the harbor and barrels of herring piled up on the wharf. Factories in the town make fish meal and oil.

Greenland and 500 miles northwest of Scotland. Its tip lies on the Arctic Circle. The many fiords give it good harbors and a long coast line (3,700 miles). About the size of Kentucky, only a quarter of its 40,000 square miles is inhabitable.

The valleys of the fiords and the narrow coastal plains in the west and south are almost the only places where men do live. Mountains rim the island like a jagged crown. The high central plateau is a windswept desert of sand and lava, ridged by mountains and strewn with glaciers and snowfields that never melt. An eighth of all Iceland is buried under snow and ice and more than half is mountainous. Some of the snow-crested peaks rise to more than 6,000 feet. Short, swift rivers form many waterfalls. Many farmers use the streams to generate their own electricity.

Volcanoes and Geysers

More than a hundred volcanoes, some still active, make Iceland one of the most volcanic regions of the world. Eruptions are rare but sometimes devastating. When Mount Laki broke out in 1783, it ruined so much pastureland that most of the livestock perished and about a fifth of the people died in the famine that followed.

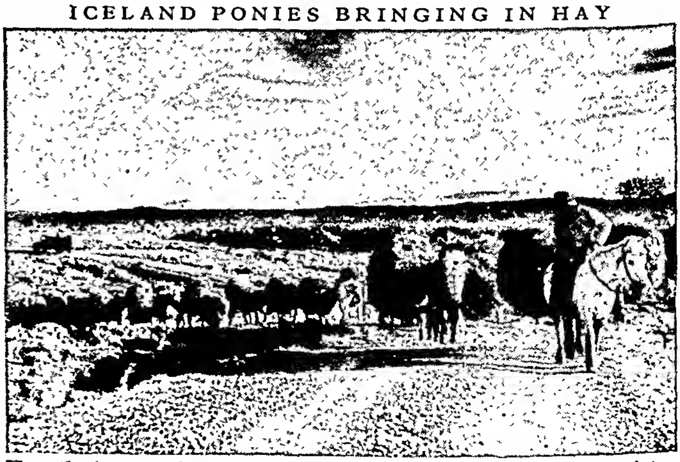
The volcanic rocks heat countless hot springs and geysers. The largest is the famous Geysir (from *geysa*, Icelandic word meaning "to rush forth furiously"), from which the world's geysers take their name (*see* Geyser). The warm waters are piped to heat buildings and hothouses, in which vegetables, fruits, and flowers grow the year around. In some places water is piped through the soil to warm it for growing green crops.

In minerals Iceland is poor. It has no iron and its only fuels are peat and lignite. Its deposits of Iceland spar, a kind of crystal used in optical instruments, seem exhausted (*see* Light). Virtually all building materials have to be imported, except sand and gravel for concrete and stone.

Though it is just below the Arctic Circle, Iceland has a moist, marine climate, for it lies in the outer edge of the Gulf Stream. Summers are cold but winters are mild. At Reykjavik, the largest city, in the southwest, the July temperature averages 48° F., about the same as at Nome, Alaska, which is in the same latitude. The January temperature, however, is 32°, against 3° at Nome. The south has a heavy precipitation, about 53 inches a year, and the mountains receive much more.

This is not a climate for easy living. There are many days of fog, rain, snow, and wintry gales. Plant life is sparse and stunted. Even though summer brings long hours of daylight, the temperature remains too low and the season is too short for good growth. Birches, the most common trees, rarely grow taller

ICELAND PONIES BRINGING IN HAY



Here the hay crop is being brought from the high meadows for winter stock feed. Small, strong Iceland ponies are the farm work animals.

PACKING COD FILLETS FOR FREEZING

In Reykjavik's modern refrigerating plants, the girls are packing cod fillets to be frozen for the European market. The cod may also be sun-dried on great racks along the beach.

than a man, partly because of the terrific winter gales. Willows reach only ten feet or so. Harsh as the climate is, the changeable weather and the moderate annual temperature bring it close to the type considered best for human activity (*see* Climate).

How the People Live

About a third of the people live on farms, though only about half of one per cent of the total area is cultivated. On a typical farm of some 640 acres only about ten acres can be worked. Most grains will not ripen in the short, cool summers. Turnips, potatoes, and hay are almost the only crops.

Since grass grows well, the farmers raise stock. They pasture the cattle and small, sturdy horses or ponies on the farm and send the sheep to forage in the mountains. They raise winter fodder in a hayfield, called a *tun*. Some farmers have trucks and farm machinery, but most of them use ponies for farm work. To make extra money, farm folk gather eider down from the wild eider ducks' nests. Many raise foxes for furs. Men and boys work on fishing boats in the spring.

Icelanders once built their houses of stone, with turf roofs. Now many of them build with concrete or imported timber and iron roofing. The living room is called *bath-stofa*, recalling the days when a bathing basin was sunk in the earth floor. Mutton, fish, and milk are leading foods. A favorite dish is *skyr*, curdled milk with cream and sugar. Most farm products are used at home; but wool, skins, hides, salted or frozen mutton, and some cheese are exported.

Fisheries Support One Third of the People

With so poor a soil, Icelanders could hardly live if it were not for the generous sea. The fisheries provide a living for nearly one third of the people and furnish more than four fifths of the exports. In proportion to population the annual catch is enormous—about three tons for each inhabitant in some years. Icelandic waters are also fished by other nations, especially the Scandinavians and the Bretons of France. These waters usually produce about a fifth of the total European catch.

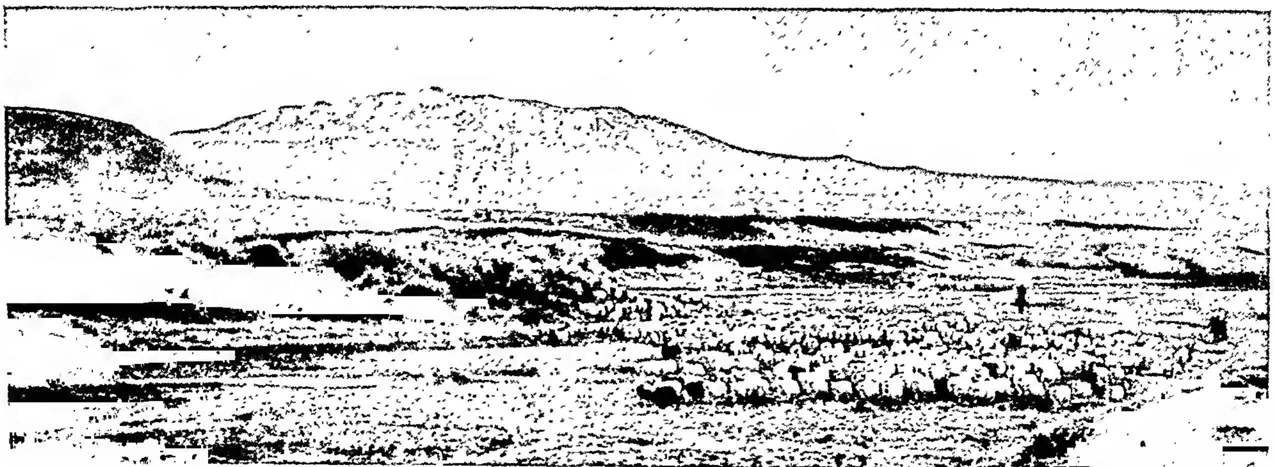
Refrigerated trawlers carry some fresh cod and herring to European markets. Most of the catch, however, is prepared in Iceland for export. The herring may be salted, spiced, or sugar cured. Cod is dried or cut into fillets for quick-freezing. A few factories make herring meal and oil and refine cod liver oil.

Ports and Transportation

More than half the people live in towns or villages. Over a third (56,096) live in Reykjavik (from *reykur*, "smoke," hence "smoking harbor"), the capital and chief port. Its harbor is ice-free the year around. Except for the absence of trees, Reykjavik looks much like any small town in the United States. It has small manufactures of clothing, foodstuffs, and equipment for the fishing fleet—nearly all from imported materials. In the north the chief port is Akureyri. The few other towns range from only about 3,500 inhabitants to fewer than 1,000.

In this land of mountains and long winters, transportation is a major problem. There is no railway,

BRINGING SHEEP FROM THE UPLAND PASTURES



These sheep have cropped the rough grasses on the plateau near Mount Hekla during the summer. Now they are returning to the community sorting corrals. Their return brings a festival day for the farmer. He gets food, clothing, and cash from his flock.

but year-round airplane service and coastal shipping connect the chief towns. A motorbus highway links Reykjavik and Akureyri, but most of the roads are unpaved and unfit for winter use. Nearly every farm has a telephone. The government radio station at Reykjavik is a major source of weather reports for Europe and for North Atlantic shipping and flying.

Aside from the descendants of early Celtic settlers, the people are Scandinavian. Nearly all were born in Iceland because immigration is discouraged. Late in the 19th century many Icelanders migrated to Canada and the United States. Nearly all the people belong to the established church, the Lutheran.

Like other Scandinavians, Icelanders are reserved, but kindly and hospitable. Most of them have given up the old national dress for modern clothes. The young people are fond of athletics and sports. They wrestle, skate, ski, play rugby, swim in hot-spring pools, and dance the modern dances. Many have taken up gliding, with homemade gliders.

A Book-Loving People

Iceland reads more books than any other nation, in proportion to population. Education is compulsory for children from 7 to 14; and there are several technical schools. At Reykjavik is the University of Iceland (1911), a co-educational institution with

A VOLCANO AND A GEYSER IN THE "LAND OF FIRE AND ICE"

Here we see streamers of ash pouring from Mount Hekla during its 1947 eruption—its 21st since 1104. As it erupted rivers of melting ice and streams of lava flowed down its rugged sides.

The Geysir, from which the world's geysers take their name, shoots a spray of steam and boiling water as high as 200 feet into the air. Here a group of visitors stands watching it spout.

The boiling water from Iceland's hot springs heats everything from homes to bathing pools and laundry tubs. The young lady (left) is boiling a trout she has just hooked in the chill waters of a mountain brook fed by the plateau ice fields. The idea of growing bananas (right) in Iceland seems strange indeed, but Icelanders plant a variety of fruits and vegetables in greenhouses warmed by the hot springs. Their diet may thus include many foods they could not raise in the short growing season.

schools of medicine, law, theology, and philosophy, and a famous library.

The Icelandic language closely resembles Norwegian. It has made two great contributions to the literature of the world. First is the *saga* (the Icelandic word for "story"). The Icelandic sagas are stories of ancient heroes, combining fact with legend. Second is the preservation of Scandinavian mythology and traditions (*see* Scandinavia). It was Iceland's poets and historians who first put these into written form. One of the honored names in world literature is that of Snorri Sturluson (1178–1241), who wrote the Prose Edda (or Younger Edda), a collection of myths and a manual of instruction for poets.

Why did the people of this lonely land achieve so high a level of culture? Part of the answer is that in the isolation of the long winter darkness they whiled away the hours by composing poetry and telling stories. Beginning in the 10th century, professional bards (*skalds*, "poets") traveled from farm to farm. When this custom died out, nearly every home held "evening wakes," to hear some member of the family recite or read aloud. Even on remote farms parents taught the children to read and write early.

More Than a Thousand Years of History

When Vikings first visited Iceland, about the year 850, it was already the home of a small Irish colony. The history of Iceland as a nation, however, begins in 874, when Norse colonists reached the island, preferring exile to the tyranny of King Harald the Fair-Haired. As they neared land, their chieftain, Ingolf Arnarson, threw the sacred columns of his wooden high seat into the sea and vowed to settle permanently wherever they drifted ashore. Three years later he found them where Reykjavik now stands. These colonists were joined by other chiefs and their households. Some of these had fled to Ireland first and so brought Celtic families with them (*see* Northmen).

HISTORIC COSTUMES OF ICELAND

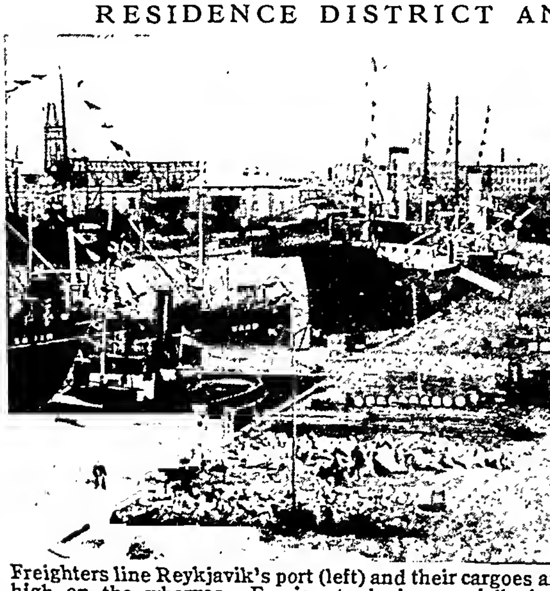
The national costume is no longer in everyday use in Iceland, but festivals bring out family heirlooms like these. Notice the embroidery on the woman's dress and the handwrought jewelry.

A liberty-loving people, they met in neighborhood assemblies, *things*, to make local laws. In 930 they established a general assembly, the *Althing*, and about the year 1000 they adopted Christianity.

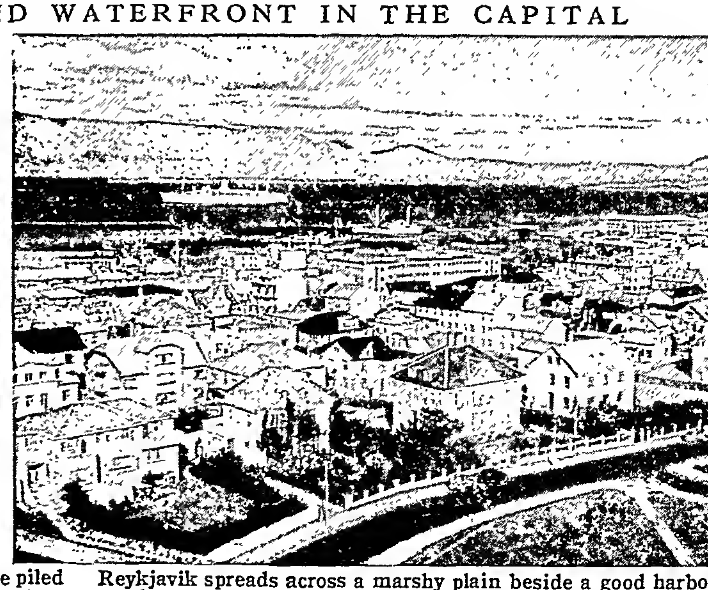
In the 13th century Iceland lost its hard-won freedom. It fell under the rule first of Norway and then of Denmark. Until late in the 19th century the country was ridden by misfortune. Its trade was exploited by Danish monopoly; volcanic eruptions and earthquakes laid the land waste; plagues killed many people.

In 1874 the undaunted Icelanders obtained the beginnings of home rule. They soon reasserted their

RESIDENCE DISTRICT AND WATERFRONT IN THE CAPITAL

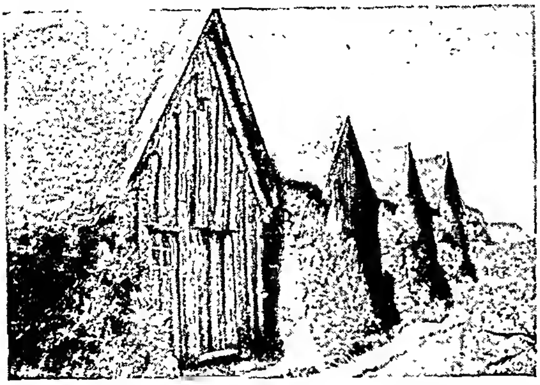


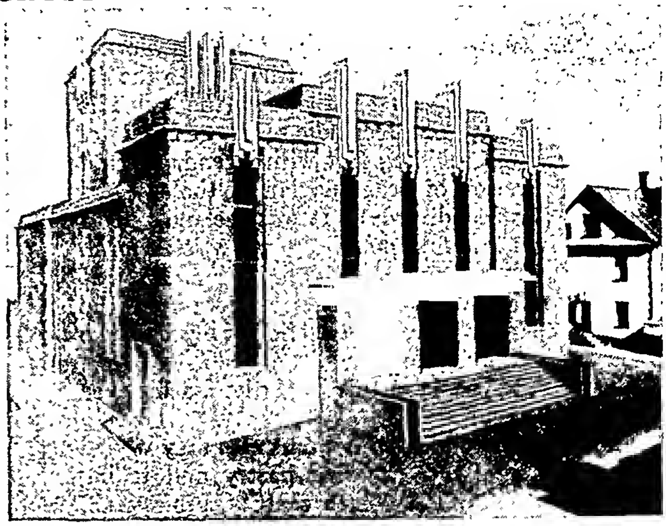
Freighters line Reykjavik's port (left) and their cargoes are piled high on the wharves. Foreign trade is especially important here, for Iceland does not produce all its food and has few industries. Its huge exports of fish help to pay for imported goods.



Reykjavik spreads across a marshy plain beside a good harbor on the southwest coast (right). It has the neat, trim look of a Scandinavian city. Many houses are built from concrete since timber is scarce. Some are heated by water from hot springs.

OLD AND NEW ARCHITECTURE IN ICELAND





The old farmhouses above are preserved as a museum for antique agricultural implements. Few such houses remain in use today though they were a sensible if crude kind of shelter in a cool land with little timber. The growing sod on sides and roof kept them warm. Iceland's National Theater, at the right, has the strong, simple lines of modern architecture.

historic ability to work for the common good. They established their first co-operative society in 1882, gave women the right to vote in local elections in the same year, and enacted an old-age pension law in 1890. In 1915 women obtained full suffrage. In 1918 Iceland again became an independent nation. It retained the king of Denmark as its nominal monarch but reserved the right to sever even that thin tie after 1943. By popular vote in 1941, Iceland decided to take this step.

In 1944 Iceland ratified constitutional amendments which declared it a republic. The parliament (still called the *Althing*) meets yearly. Its members elect one third of their number to the upper house; the remaining two thirds form the lower house. The president, elected by popular vote, serves four years.

World War II gave Iceland strategic importance. Since Iceland has no army or navy, Great Britain occupied it in 1940 to keep Germany from seizing it. In 1941 Iceland asked the United States to take over. American forces built weather stations and defense bases (*see* World War, Second). In 1949, despite Communist riots, Iceland signed the North Atlantic Treaty. At Iceland's request American forces returned in 1951.

In 1952, Iceland established a four-mile limit within which foreign or domestic trawling and dragnet fishing were forbidden. This was done to increase fish resources after the herring catch had been depleted. (For Reference-Outline and Bibliography, *see* Denmark.)

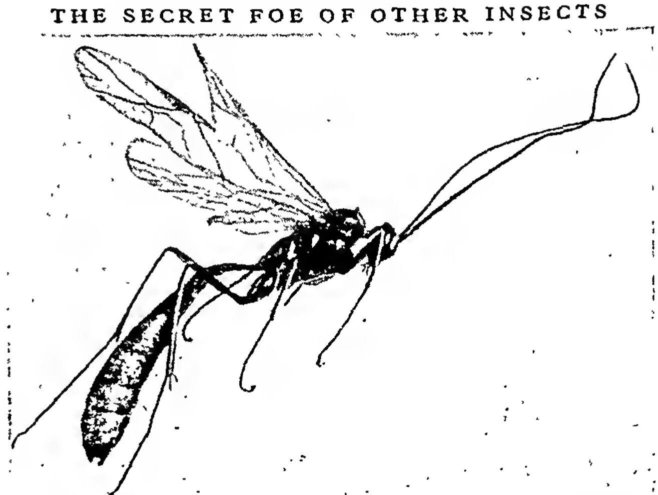
ICHNEUMON (*ĭk-nū'mŏn*). This is the common name for weasellike animals of Africa, Asia, and southern Spain, comprising the genus *Herpestes*. The Indian species is known as the mongoose (*see* Mongoose). The name is applied especially to the Egyptian species (*Herpestes ichneumon*), also called "pharaoh's rat." It destroys snakes, rats, mice, crocodile and bird eggs, and poultry. The word *ichneumon* is from the Greek. It means "tracker."

ICHNEUMON FLIES. These graceful four-winged insects are not flies, but are relatives of wasps, ants, and bees. They are of great value to farmers and tree growers. The females lay their eggs on or near the eggs and larvae of many different kinds of harmful insects. After the eggs hatch, the ichneumon larvae feed on the other larvae and kill them.

Ichneumon flies vary in size, but all have long, slender abdomens with long legs which trail gracefully as the insect flies through the air. From the abdomen of the female extends a threadlike egg-laying organ called an *ovipositor* ("egg depositor"). In some species the organ reaches the amazing length of eight inches. The antennae are also very long.

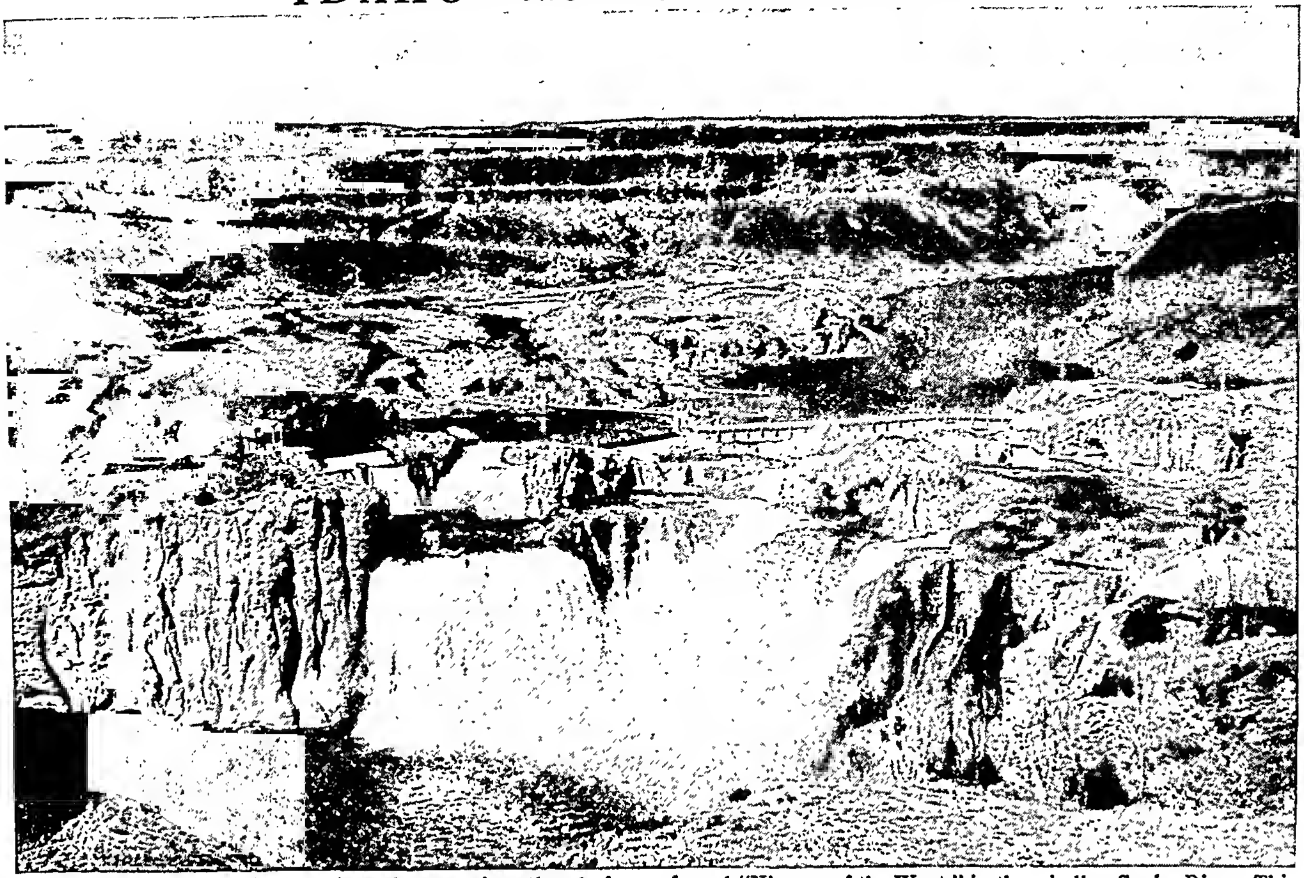
They belong to the family *Ichneumonidae* of the order *Hymenoptera*. More than 1,600 species have been described. A large genus is the *Megarhyssa*, which measures ten inches from the tip of the antenna to the tip of the ovipositor. The long ovipositor is used to reach wood-boring larvae.

THE SECRET FOE OF OTHER INSECTS



One of the ichneumon flies is this yellow Ophion. Its larvae destroy the caterpillars of the Polyphemus moths after they have made cocoons.

IDAHO—*the* "GEM STATE"



Sparkling lakes, green forests, jagged mountains, thundering waterfalls, and vast stretches of one-time desert turned into fertile farmland—these are Idaho. Here we see Shoshone Falls, famed "Niagara of the West," in the winding Snake River. This mighty cascade frequently dwindles to a mere trickle because much of the Snake's water is diverted for irrigation of farms.

IDAHO. The Shoshone Indians appreciated the wild beauty of the Idaho region. They gave it the name *Ee-dah-how,* meaning "Look, the sun is coming down the mountains" or "gem of the mountains."

The pioneer settlers appropriately called Idaho the "Panhandle State" because of its shape. Its strange boundaries were fixed as the borders of the territories and states surrounding it were created. Originally Idaho was part of the vast Oregon country ceded by England in 1846 and later of the Oregon Territory established in 1848. In the following two decades it underwent five boundary changes.

The 305-mile-long Panhandle is bounded for only 45 miles on the north by Canada. On the east the Bitterroot Range is a natural boundary with Montana, as is the Snake River in the west along parts of the Oregon and Washington borders. However, the boundaries with Wyoming, Utah, Nevada, and much of Oregon and Washington are neither natural nor logical. The state widens in its 480-mile length to 310 miles between Oregon and Wyoming.

With so peculiar a shape, it is no surprise that Idaho's land surface varies greatly. The state lies in four topographic provinces of the United States.

In the north and center are the *Northern Rockies,* covering most of Idaho. The Clearwater and Salmon River mountains (part of the Rockies) are a barrier between northern and southern Idaho. The *Middle Rockies* are along the Wyoming border. The *Columbia Plateau* follows the grand sweep of the Snake River through southern Idaho and northward along the western border. The eastern part of the plateau is known as the Snake River Plain. The *Basin and Range province* reaches northward from Nevada and Utah, and its Great Basin section, made up of isolated ranges and desert plains, extends into southern Idaho.

Idaho's principal rivers are the Snake and the Salmon. The Snake River begins in Wyoming and winds through the tremendous Snake River Gorge across southern Idaho. Along the state's western boundary the river flows through the Grand Canyon of the Snake. The Salmon River starts high in the mountains of central Idaho, rushes through almost inaccessible forest lands, and then joins the Snake near where that river enters the state of Washington.

A State of Many Resources

Scarcely anywhere are there mightier mountains, greener meadows, richer farms, or a more generous store of precious things than in Idaho. The rough face of the state is spotted with small, bright lakes. Particularly beautiful are those in the north—Priest, Pend Oreille, and Coeur d'Alene.

Clear streams, flung down the sheer rocky sides of the mountains, make long white waterfalls that rival Niagara in grandeur. Shoshone Falls, where the Snake River plunges 212 feet into a dark-green lake at the

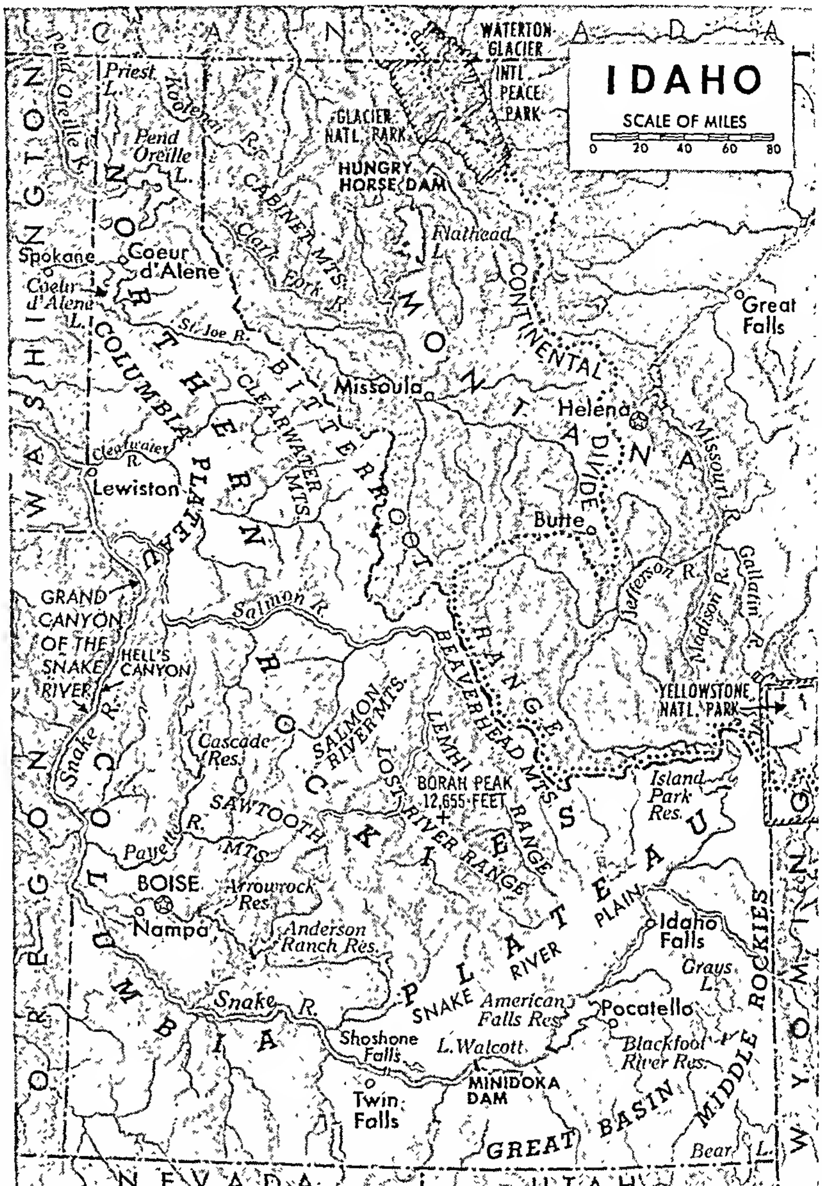
bottom of a deep gorge, is equaled in magnificence only by the falls of the Niagara and Yosemite.

Next to Washington, Idaho has the most undeveloped water power of any state. Dams and reservoirs store water for power and irrigation. The main dams include the American Falls, Minidoka, Anderson Ranch, Arrowrock, and Cabinet Gorge.

Cattle graze in the tall grass of the upland valley meadows and on the wide plateaus. Geologists come from far away to study the lava beds of central and southern Idaho, which were poured down long ago from volcanoes now dead. The rain, frost, and winds of millenniums have broken up the lava into a soil of unusual fertility.

Sick people come to the healing waters of the hot and mineral springs. Hot springs are so numerous that water piped from them is used in winter to heat houses in Boise, the capital. Other springs supply water that is almost ice cold all summer. Currents of cold air from deep wells are used on many farms for refrigeration.

Mountainous Idaho has a widely varying climate. The southern and central sections are arid, with practically no rain in summer but with heavy snowfalls in winter. In the higher regions the winters are long and severe, but the lower valleys, sheltered by the Rockies and swept by winds from the Pacific, have mild winters. Some of the higher valleys are so sheltered that cattle can roam in the winter. Spring comes back to parts of Idaho long before it reaches some more southerly states.



Immediately apparent on a relief map of Idaho are the state's peculiar shape, high mountains, and winding rivers. A large part of Idaho is mountainous. Many rivers wind between the ranges and peaks of the Rockies. Greatest are the Snake and the Salmon.

The dams, reservoirs, and about 15,000 miles of irrigation canals along the Snake's course have transformed what was once a desert into the best farming land of the state. Wheat, alfalfa, timothy, and oats grow luxuriantly here, as well as in the fertile northern valleys where no irrigation is needed. Especially in the southeastern part, fine macaroni wheat is raised by dry farming. Idaho is famous for its potatoes. Sugar beets, beans, peas, and barley are also important crops.

The state grows more than one third of all the vegetable seeds produced in the United States. The Boise, Weiser, and Payette valleys and the district around Lewiston produce apples, cherries, prunes, pears, apricots, and peaches.

Livestock raising is a leading industry. Idaho usually ranks high in sheep and wool production. Cattle and hogs also contribute to the state's farm income. More of Idaho's working people are employed in agriculture than in any other occupation.

Timberland covers about one third of the state. Western white pine, yellow pine, lodgepole pine, white fir, Douglas fir, Engelmann spruce, and other conifers make lumbering a valuable industry in the state, which produces nearly 900 million board feet each year.

Large forested tracts, known as Primitive, or Wilderness, Areas, have been set aside for recreation and wildlife shelters. They occupy both sides of the Salmon River west and northwest of the town of Salmon.

Continued on page 23

Idaho Fact Summary

IDAHO (no abbr.): Common meaning of name—"gem of the mountains"; contraction of *Ee-dah-how,* Shoshone Indian word meaning "Look, the sun is coming down the mountain."

Nickname: "Gem State," or "Gem of the Mountains," from residents' idea of the state.

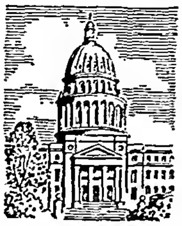
Seal: Shield showing river, mountain peaks, and rising sun; miner with pick and shovel to right of shield; to the left of shield a woman holds scales of justice and spear with cap of liberty on point.

Motto: Esto Perpetua (May She Endure Forever).

Flag: For description and illustration, *see* Flags.

Flower: Syringa. **Bird:** Mountain bluebird. **Tree:** White pine. **Song:** 'Here We Have Idaho'—words, Lulu M. Huffman; music, Sallie Hume Douglas.

THE GOVERNMENT



Capital: Boise (since 1864, when it became territorial capital).

Representation in Congress: Senate, 2; House of Representatives, 2. Electoral votes, 4.

State Legislature: Senators, 44; term, 2 years. Representatives, 59; term, 2 years. Convenes first Monday after January 1 in the odd-numbered years. The session length is limited to 60 days.

Constitution: Adopted 1890. Proposed amendment must be (a) passed by a two-thirds vote of the legislature and (b) ratified by a majority voting on amendment at a popular election.

Governor: Term, 4 years. May not succeed himself.

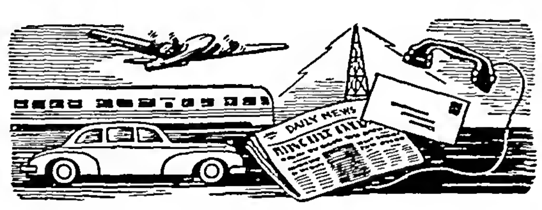
Other Executive Officers: Lieutenant governor, secretary of state, attorney general, treasurer, auditor, mine inspector, all elected; terms, 4 years.

Judiciary: Supreme court—5 justices, elected at large; term, 6 years. District courts—11; 16 judges elected; term, 4 years. Probate courts—1 in each county; judges elected; term, 2 years.

County: 44 counties, each governed by a board of commissioners of 3 members. Board members elected; term, 2 to 4 years; officers elected; term, 2 years.

Municipal: Mayor and council most common.

Voting Qualifications: Age, 21; residence in state, 6 months; in county, 30 days.



TRANSPORTATION AND COMMUNICATION

Transportation: Railroads, 2,700 miles. First railroad, Utah and Northern crossed southern boundary, 1874. Rural roads, 40,400 miles. Airports, 151.

Communication: Periodicals, 10. Newspapers, 96. First newspaper, *Golden Age,* Lewiston, 1862. Radio stations (AM and FM), 23; first station, KFXD (originally licensed in Logan, Utah, 1922; moved to Jerome, 1926, and to Nampa, 1929). Television stations, 1; KIDO-TV, Boise, began operation July 1, 1953. Telephones, 158,700. Post offices, 387.

THE PEOPLE AND THEIR LAND

Population (1950 census): 588,637 (rank among 48 states—43d); urban 42.9%; rural 57.1%. Density: 7.1 persons per square mile (rank—43d state).

Extent: Area, 83,557 square miles, including 788 square miles of water surface (12th state in size).

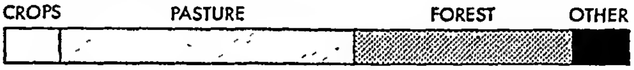
Elevation: Highest, Borah Peak, 12,655 feet, near Chilly; lowest, Snake River near Lewiston, 720 feet.

Temperature (°F.): Average—annual, 46°; winter, 26°; spring, 45°; summer, 65°; fall, 47°. Lowest recorded, −60° (Island Park Dam, Fremont County, Jan. 18, 1943); highest recorded, 118° (Orofino, July 28, 1934).

Precipitation: Average (inches)—annual, 17; winter, 6; spring, 5; summer, 2; fall, 4. Varies from about 8 in southwest to about 50 in central northeast.

Natural Features: Four provinces divide Idaho—Northern Rockies (Cabinet, Coeur d'Alene, Beaverhead, Clearwater, and Salmon River mountains and Bitterroot Range) in north and center; Middle Rockies in southeast; Basin and Range (Great Basin section) in south; Columbia Plateau, including Snake River Plain, in south and west. Chief rivers: Snake, Salmon, Clearwater, St. Joe, Payette. Chief lakes: Pend Oreille, Coeur d'Alene, Priest, Bear. Waterfalls: American, Twin, Shoshone.

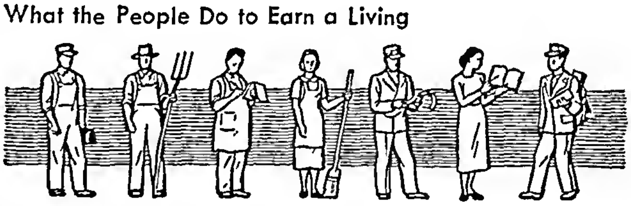
Land Use: Cropland, 9%; nonforested pasture, 47%; forest, 35%; other (roads, parks, game refuges, wasteland, cities, etc.), 9%.



Natural Resources: *Agricultural*—fertile valleys, good grazing land for cattle and sheep. *Industrial*—great tracts of timberland; lead, silver, zinc, copper, gold, antimony, phosphate rock, sand and gravel, stone. *Commercial*—wildlife and recreation areas.

OCCUPATIONS AND PRODUCTS

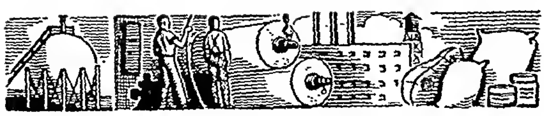
What the People Do to Earn a Living



Major Industries and Occupations, 1950

Fields of Employment	Number Employed	Percentage of Total Employed
Agriculture, forestry, and fishery	56,108	27.3
Wholesale and retail trade	39,493	19.3
Manufacturing	18,989	9.2
Transportation, communication, and other public utilities	18,577	9.0
Professional services (medical, legal, educational, etc.)	17,033	8.3
Construction	15,501	7.5
Personal services (hotel, domestic, laundering, etc.)	10,757	5.2
Government	7,913	3.8
Business and repair services	6,202	3.0
Mining	5,374	2.6
Finance, insurance, and real estate	4,816	2.3
Amusement, recreation, and related services	2,134	1.0
Workers not accounted for	3,096	1.5
Total employed	205,993	100.0

Idaho Fact Summary



What the People Produce

A. Manufactured Goods (Rank among states—42d)
Value added by manufacture* (1952), $142,553,000

Leading Industries in 1947 (with Principal Products)	Value Added by Manufacture	Rank among States
FOOD AND KINDRED PRODUCTS..... Beet sugar; creamery butter; flour and meal; bakery products	$43,653,000	31
LUMBER AND PRODUCTS........... Sawmills and planing mills; wooden containers..................	43,396,000	20
PRIMARY METAL INDUSTRIES...... (Such as gray-iron foundries; lead smelting and refining; zinc smelting and refining)	10,492,000	30
PRINTING AND PUBLISHING........ Newspapers	4,968,000	42
STONE, CLAY, AND GLASS PRODUCTS Concrete products	1,614,000	44
CHEMICALS AND ALLIED PRODUCTS.	1,609,000	46
MACHINERY (EXCEPT ELECTRICAL). Farm Machinery (except tractors)	1,194,000	41

*For explanation of value added by manufacture, *see* Census.

B. Farm Products (Rank among states—34th)
Total cash income (1952), $368,176,000

Products	Amount Produced (10-Year Average)	Rank within State*	Rank among States†
Wheat.........	31,154,000 bu.	1	11
Hay...........	2,419,000 tons	2	17
Potatoes.......	37,379,000 bu.	3	2
Milk...........	604,000,000 qts.	4	28
Cattle.........	222,977,000 lbs.	5	27
Sheep and lambs	98,412,000 lbs.	6	6
Hogs...........	101,359,000 lbs.	7	29
Beans, dry edible	1,999,000 bags	8	3

*Rank in dollar value †Rank in units produced

C. Minerals (Fuels, Metals, and Stone)
Annual value (1951), $82,793,000
Rank among states—27th

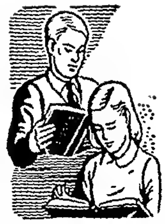
Minerals (1951)	Amount Produced	Value
Zinc..................	78,000 tons	$28,436,000
Lead..................	77,000 tons	26,543,000
Silver................	15,000,000 ozs.	13,352,000
Sand and gravel.......	4,057,000 tons	2,971,000
Stone.................	1,457,000 tons	1,811,000

D. Lumber (Rank among states—13th)
879,000,000 board feet (5-year average)

E. Trade

Trade (1948)	Sales	Rank among States
Wholesale.......	$415,822,000	43
Retail..........	581,844,000	41
Service.........	42,824,000	43

EDUCATION



Public Schools: Elementary, 532; secondary, 133. Compulsory school age, 7 through 16. State Board of Education consists of 5 members appointed by governor for 5-year terms. State supt. of public instruction elected for 4-year term. In some counties, county boards of education, elected by school district trustees for 3-year terms, appoint county supts. City school boards, elected by school electors, appoint city supts.

Private and Parochial Schools: 46.

Colleges and Universities (accredited): Colleges, 5; junior colleges, 2. State-supported schools include the University of Idaho, Moscow; Idaho State College, Pocatello.

State Schools for the Handicapped: School for Deaf and Blind, Gooding; Nampa School and Colony, Nampa.

Libraries: City and town public libraries, 77; State Traveling Library aids in developing library service. Noted special library: State Law Library, Boise.

Outstanding Museum: State Historical Museum, Boise.

CORRECTIONAL AND PENAL INSTITUTIONS

Industrial Training School (boys and girls), St. Anthony; State Penitentiary, Boise.

LARGEST CITIES (1950 census)

Boise (34,393): state capital, mining, agricultural area; large construction firms; makes steel products.

Pocatello (26,131): railroad center with large terminals and shops; produces cement, creamery products, flour.

Idaho Falls (19,218): shipping point for potatoes, sugar beets, seed; flour and sugar-beet mills; livestock.

Twin Falls (17,600): distribution center for highly productive, irrigated farming area; meat packing.

Nampa (16,185): rail center of southwest Idaho; shipping point for farm area; sugar refinery; milk condensing.

Lewiston (12,985): lumber industry; food processing.

Coeur d'Alene (12,198): center of lumbering and farming area; many lumber mills; scenic resort.

STATE PARK*

Heyburn—east of Plummer; lake and forest park; includes Lakes Chatcolet, Hidden, Round, and Benewah; Rocky Point rises 150 feet; Indian cliffs; wildlife (7).

STATE FORESTS*†

Floodwood (Shoshone and Clearwater Counties)—60,438 acres; southwest of (8).

Lolo (Clearwater and Idaho Counties)—60,384 acres; west of (9).

Orofino (Clearwater County)—95,613 acres; west of (9).

Payette Lakes (Valley County)—13,000 acres; e. of (14).

Priest Lake (Boundary and Bonner Counties)—193,251 acres; west of (1).

PLACES OF INTEREST*

American Falls Dam—at American Falls; nearly 1 mile long; key reservoir of great irrigation section (29).

Anderson Ranch Dam—world's highest earth dam, 456 feet high; southeast of Boise and (27).

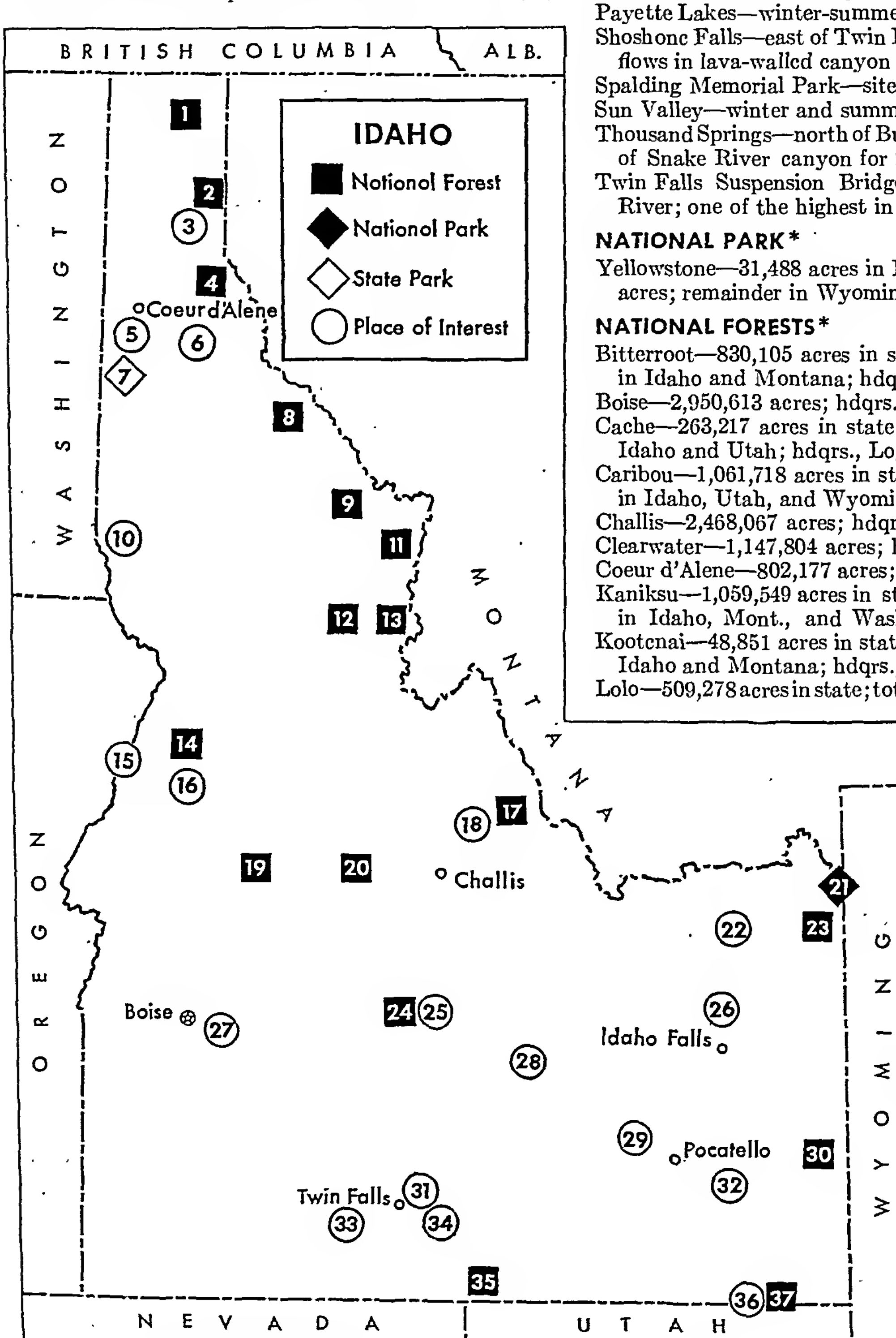
Arrowrock Dam—east of Boise; 350 feet high; one of world's highest irrigation dams (27).

Balanced Rock—near Castleford; mushroom-shaped formation, 40 ft. high, rests on stone $1 \times 1\frac{1}{2} \times 3$ ft. (33).

*Numbers in parentheses are keyed to map.
†The state also owns about 384,000 additional acres of commercial forest land in scattered sections.

Idaho Fact Summary

City of Rocks—northwest of Gooding; weird rock formations in colorful gorges; 4 miles long; northwest of (31).
Coeur d'Alene Lake—has great beauty; noted for variations of blue on its surface (5).
Craters of the Moon National Monument—cones and craters resembling the surface of the moon (28).
Cronks Canyon—near Salmon; known as Royal Gorge of Idaho; spectacular coloring on walls and bluffs (18).
Crystal Falls Cave—northwest of St. Anthony; ice crystals form clusters of flowers (22).
Franklin—state's first permanent white settlement (36).
Grand Canyon of the Snake River (deepest part in south called Hell's Canyon or Seven Devils Gorge)—long canyon along Idaho-Oregon border; deepest gorge in North America; a scenic wonder of the West; greatest depth, 7,900 feet; average depth, 5,500 feet (15).
Lake Pend Oreille—Idaho's largest lake (3).
Lava Hot Springs—mineral springs, swimming pools (32).
Menan Buttes—deep craters of extinct volcanoes (26).
Mission of Sacred Heart Church—near Kellogg; oldest standing building in state; built in 1842 (6).
Packer John Cabin—early settler's home (16).
Payette Lakes—winter-summer resorts near McCall (16).
Shoshone Falls—east of Twin Falls; water of Snake River flows in lava-walled canyon over 212-foot drop (31).
Spalding Memorial Park—site of first mission (10).
Sun Valley—winter and summer resort area (25).
Thousand Springs—north of Buhl; springs gush from walls of Snake River canyon for 2 miles; northeast of (31).
Twin Falls Suspension Bridge—476 feet above Snake River; one of the highest in the world (34).



NATIONAL PARK*

Yellowstone—31,488 acres in Idaho of total of 2,213,207 acres; remainder in Wyoming and Montana (21).

NATIONAL FORESTS*

Bitterroot—830,105 acres in state; total 2,005,351 acres in Idaho and Montana; hdqrs., Hamilton, Mont. (13).
Boise—2,950,613 acres; hdqrs., Boise (19).
Cache—263,217 acres in state; total, 1,216,332 acres in Idaho and Utah; hdqrs., Logan, Utah (37).
Caribou—1,061,718 acres in state; total, 1,078,086 acres in Idaho, Utah, and Wyoming; hdqrs., Pocatello (30).
Challis—2,468,067 acres; hdqrs., Challis (20).
Clearwater—1,147,804 acres; hdqrs., Orofino (9).
Coeur d'Alene—802,177 acres; hdqrs., Coeur d'Alene (4).
Kaniksu—1,059,549 acres in state; total, 1,639,050 acres in Idaho, Mont., and Wash.; hdqrs., Sandpoint (1).
Kootenai—48,851 acres in state; total, 2,102,656 acres in Idaho and Montana; hdqrs., Libby, Mont. (2).
Lolo—509,278 acres in state; total, 2,235,568 acres in Idaho and Mont.; hdqrs., Missoula, Mont. (11).
Minidoka—544,383 acres in state; total, 636,786 acres in Idaho and Utah; hdqrs., Burley (35).
Nezperce—1,976,045 acres; hdqrs., Grangeville (12).
Payette—2,418,977 acres; hdqrs., McCall (14).
St. Joe—1,089,180 acres; hdqrs., St. Maries (8).
Salmon—1,790,944 acres; hdqrs., Salmon (17).
Sawtooth—1,245,973 acres; hdqrs., Hailey (24).
Targhee—1,346,481 acres in state; total, 1,691,054 acres in Idaho and Wyoming; hdqrs., St. Anthony (23).

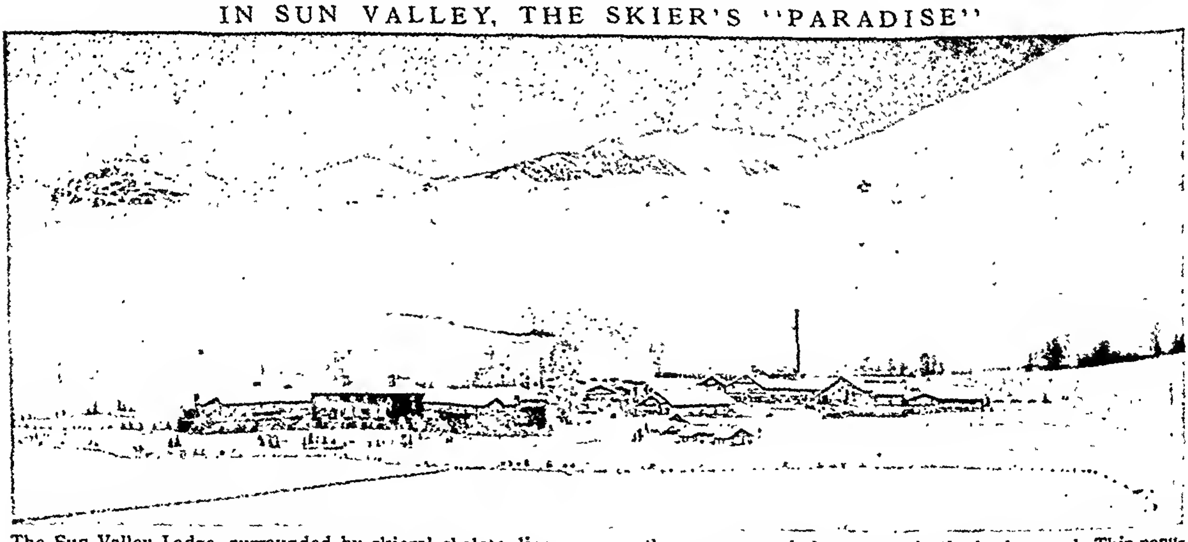
*Numbers in parentheses are keyed to map.

Idaho Fact Summary

THE PEOPLE BUILD THEIR STATE

1805—Meriwether Lewis and William Clark enter present Idaho through Lolo Pass en route to the Pacific; return, 1806.
1809—David Thompson, noted geographer, establishes North West Company fur-trading post near site of Hope; maps region.
1810—Missouri Fur Company builds trading post, Fort Henry, near present St. Anthony.
1811—John Jacob Astor's fur-trading expedition under Wilson Price Hunt reaches Idaho region.
1819—Spain surrenders its claim to area west of Rocky Mountains and north of 42d parallel, includes present Idaho; Russia cedes its claim to same area south of 54°40′ N., 1824.
1821—Hudson's Bay Company takes over North West Company; controls fur trade for next 48 years.
1832—Capt. B. L. E. Bonneville's fur-trading expedition explores southern Idaho region.
1834—Nathaniel Wyeth builds Fort Hall; raises U. S. flag for first time in Idaho country. Jason Lee conducts first religious service in region at Fort Hall; Hudson's Bay Company builds Fort Boise.
1836—Hudson's Bay Company buys Fort Hall. Henry Spalding establishes first mission in area on Lapwai Creek; is first permanent white settler in Idaho; opens first school in area, for Indian children; builds first gristmill and sawmill in region.
1842—Jesuit mission founded near Coeur d'Alene.
1843—John C. Frémont explores area along Oregon Trail. Oregon country provisional government formed.
1846—U. S.-Great Britain boundary dispute settled; British cede territory south of 49th parallel.
1848—Oregon Territory created; includes Idaho area.
1852—H. M. Chase finds gold near Grand Ronde River.
1855—Mormon mission is built in Lemhi Valley; settlers begin first irrigation in region; mission abandoned after Indian raid in 1858.
1860—Mormons make first settlement at Franklin; open first school for white children. Gold discovered on Orofino Creek by Capt. E. D. Pierce.
1861—Fresh gold strikes made on Salmon and Boise rivers; new mining towns soon spring up.
1862—National Homestead Act encourages settlement.
1863—Congress establishes Idaho Territory, March 3; Lewiston, temporary capital; includes Montana and part of Wyoming; Montana becomes separate territory, 1864; Wyoming separated, 1868.
1864—Capital moved to Boise.
1866—First telegraph lines in territory are built.
1877—Nez Percé War breaks out when attempt is made to settle Indians on reservations; war ends, 1878; Indians largely on reservations by about 1880.
1884—Coeur d'Alene lead-silver deposits discovered.
1889—University of Idaho founded at Moscow.
1890—Idaho admitted to Union as 43d state, July 3; capital, Boise; governor, George L. Shoup.
1892—Silver and lead mine strikes occur; federal and state troops called; violence recurs, 1894, 1899.
1894—National Carey Act grants Idaho 1,000,000 acres of public land to be reclaimed by irrigation.
1896—Idaho grants women right to vote.
1901—Free traveling library authorized.
1902—Federal Reclamation Law begins to aid state's irrigation; responsible for Minidoka, King Hill, and Boise projects; Arrowrock Dam completed, 1915.
1905—Ex-Gov. Frank Steunenberg murdered; mine-union leaders charged with crime are prosecuted by William Borah, who thus gains national prominence.
1915—Open waterway connects Lewiston and Pacific Ocean by way of Snake and Columbia rivers.
1927—State's first north-south highway and American Falls Dam on Snake River completed.
1931—U. S. Forest Service and state legislature act to conserve Primitive Area in central Idaho.
1936—Sun Valley summer and winter resort opens.
1949—U. S. Atomic Energy Commission selects site for atomic testing station near Arco.
1950—Idaho Indians granted full citizenship. Anderson Ranch Dam, world's highest earth dam, completed.
1951—Reactor Testing Station near Arco produces first useful atomic power; heat from burning uranium 235 runs steam turbine and electric generator.
1953—Cabinet Gorge Dam on Clark Fork R. completed.

IN SUN VALLEY, THE SKIER'S "PARADISE"



The Sun Valley Lodge, surrounded by skiers' chalets, lies on the floor of the valley in the heart of the Sawtooth Mountains. Four ski runs, adapted to varying degrees of skill, are situated on the snow-capped slopes seen in the background. This popular winter-summer resort, bathed in the warmth of sunshine, includes facilities for year-round swimming and ice skating.

IDAHO

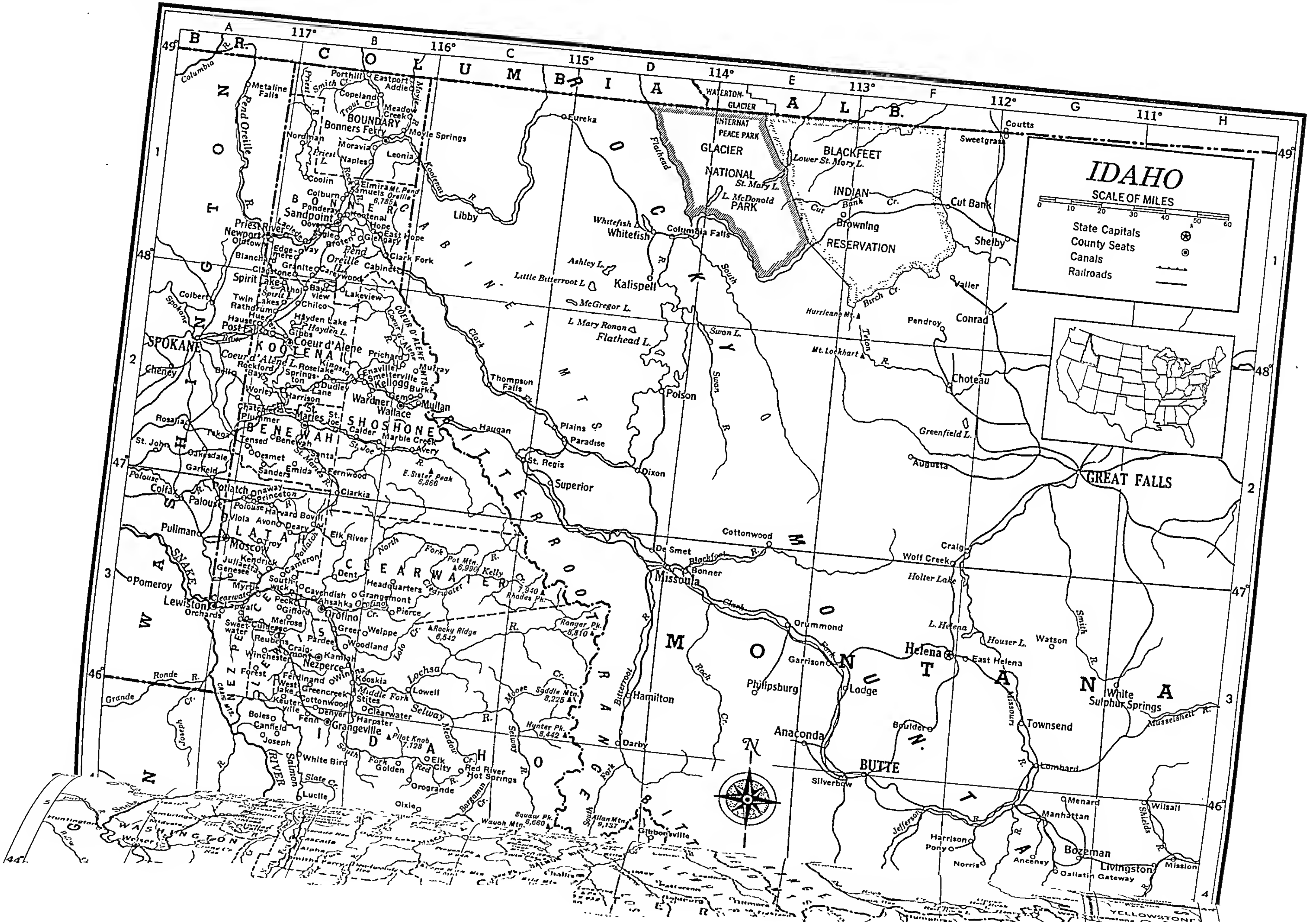
COUNTIES

Ada	70,649	B 6
Adams	3,347	B 5
Bannock	41,745	F 7
Bear Lake	6,834	G 7
Benewah	6,173	B 2
Bingham	23,271	F 6
Blaine	5,384	D 6
Boise	1,776	C 6
Bonner	14,853	B 1
Bonneville	30,210	G 6
Boundary	5,908	B 1
Butte	2,722	E 6
Camas	1,079	D 6
Canyon	53,597	B 6
Caribou	5,576	G 7
Cassia	14,629	E 7
Clark	918	F 5
Clearwater	8,217	C 3
Custer	3,318	D 5
Elmore	6,687	C 6
Franklin	9,867	G 7
Fremont	9,351	G 5
Gem	8,730	B 6
Gooding	11,101	D 6
Idaho	11,423	C 4
Jefferson	10,495	F 6
Jerome	12,080	D 7
Kootenai	24,947	B 2
Latah	20,971	B 3
Lemhi	6,278	D 4
Lewis	4,208	B 3
Lincoln	4,256	D 6
Madison	9,156	G 6
Minidoka	9,785	E 7
Nez Perce	22,658	B 3
Oneida	4,387	F 7
Owyhee	6,307	B 7
Payette	11,921	B 5
Power	3,988	F 7
Shoshone	22,806	B 2
Teton	3,204	G 6
Twin Falls	40,979	D 7
Valley	4,270	C 5
Washington	8,576	B 5
Yellowstone Nat'l Park†		G 5

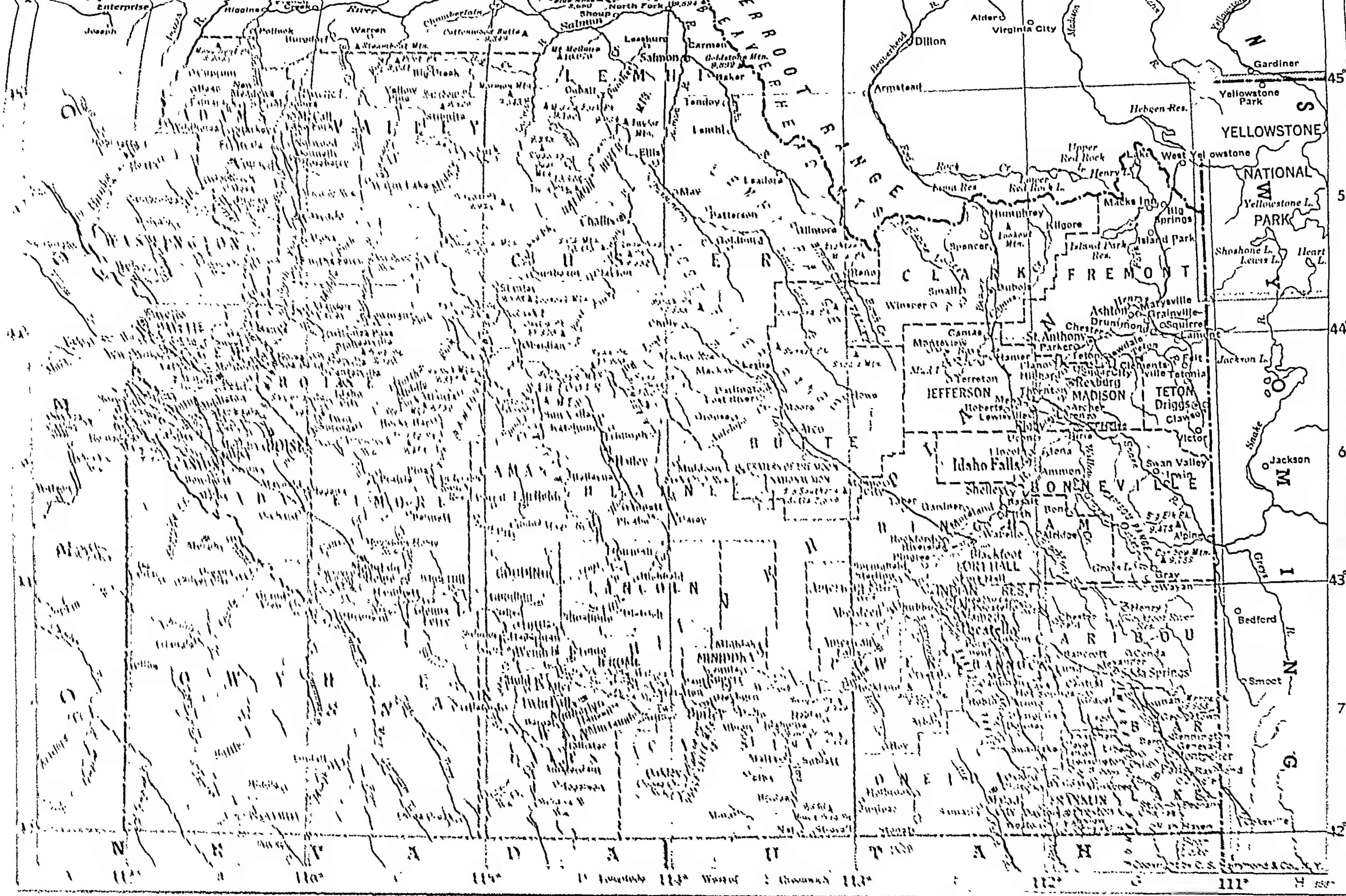
CITIES AND TOWNS

Aberdeen	1,486	F 7
Acequia	125	E 7
Addie	15	B 1
Ahsahka		B 3
Alameda	4,694	F 7
Albion	610	E 7
Alexander		G 7
Almo		E 7
Alpha		C 5
Alpine	172	G 6
Alridge		G 6
American Falls	1,874	E 7
Ammon	447	G 6
Amsterdam	100	D 7
Arbon		F 7
Archer	400	G 6
Arco	961	E 6
Arimo	337	F 7
Ashton	1,256	G 5
Athol	226	B 2
Atlanta	300	C 6
Atomic City	500	F 6
Avery	350	C 2
Avon	6	B 3
Baker	150	E 4
Bancroft	495	G 7
Banida	140	G 7
Banks		B 5
Basalt	227	F 6
Bayview	150	B 2
Bear		B 4
Bellevue	528	D 6
Benewah	50	B 2
Bennett	10	C 6
Bennington	200	G 7
Berger		D 7
Bern	140	G 7
Big Creek	24	C 4
Big Springs	5	G 5
Blackfoot	5,180	F 6
Blanchard	200	A 1
Bliss	126	D 7
Bloomington	302	G 7
BOISE	34,393	B 6
Boles	25	B 4
Bone	50	G 6
Bonners Ferry	1,776	B 1
Bovill	437	B 3
Bowmont		B 6
Bridge		E 7
Broten	30	B 1
Bruneau	100	C 7
Buhl	2,870	D 7
Burgdorf		B 4
Burke	800	C 2
Burley	5,924	E 7
Burmah		D 6
Cabinet	60	B 1
Calder	65	B 2
Caldwell	10,487	B 6
Camas	40	F 5
Cambridge	354	B 5
Cameron	83	B 3
Canfield	50	B 4
Carey	1,100	E 6
Careywood	50	B 1
Carmen		E 4
Cascade	943	C 5
Castleford	500	C 7
Cavendish		B 3
Centerville	25	C 6
Central	120	G 7
Challis	728	D 5
Chatcolet	92	B 2
Chester	247	G 5
Chesterfield		F 7
Chilco	45	B 2
Chilly	84	E 5
Chubbuck	120	F 7
Churchill		D 7
Clagstone	15	B 1
Clark Fork	387	B 1
Clarkia	150	B 2
Clarkville	19	*B 2
Clawson	34	G 6
Clayton	75	D 5
Clearwater	53	C 3
Clementsville	38	G 6
Cleveland	135	G 7
Cliffs	32	B 7
Clifton	201	F 7
Cobalt	10	D 4
Coeur d' Alene	12,198	B 2
Colburn		B 1
Conda	330	G 7
Coolin		B 1
Copeland	11	B 1
Corral	157	D 6
Cottonwood	689	B 3
Council	748	B 5
Craigmont	594	B 3
Crouch	60	B 5
Crystal		F 7
Culdesac	175	B 3
Cuprum	20	B 4
Dalby	13	*G 6
Darlington	200	E 6
Dayton	287	F 7
De Lamar		B 6
Deary	320	B 3
Declo	219	E 7
Dent		B 3
Denver	29	B 4
Desmet		B 2
Dietrich	160	D 7
Dingle		G 7
Dixie	56	C 4
Donnelly	595	C 5
Dover	385	B 1
Downey	748	F 7
Driggs	941	G 6
Drummond	59	G 5
Dubois	430	F 5
Dudley		B 2
Eagle	500	B 6
East Hope	149	B 1
Eastport	108	B 1
Eddiville	10	*B 2
Eden	456	D 7
Edgemere	96	B 1
Elba	180	E 7
Elk City	300	C 4
Elk River	312	B 3
Ellis		D 5
Elmira	128	B 1
Emida	125	B 2
Emmett	3,067	B 6
Enaville	60	B 2
Fairfield	502	D 6
Fairview	398	G 7
Felt	120	G 6
Fenn	57	B 4
Ferdinand	206	B 3
Fernwood	200	B 2
Filer	1,425	D 7
Firth	293	F 6
Fish Haven	260	G 7
Forest		B 3
Fort Hall	80	F 6
Franklin	467	G 7
French Creek	65	B 4
Fruitland	573	B 6
Fruitvale	125	B 5
Gannett	43	D 6
Garden City	764	B 6
Garden Valley	210	C 5
Gardena	120	B 5
Gardner		F 6
Gem	500	C 2
Genesee	552	B 3
Geneva		G 7
Georgetown	404	G 7
Gibbonsville	200	E 4
Gibbs	35	B 2
Gifford	51	B 3
Gilmore	50	E 5
Glengary		B 1
Glenns Ferry	1,515	C 7
Goldburg		E 5
Golden	100	C 4
Gooding	3,099	D 7
Goodrich	16	B 5
Grace	761	G 7
Grainville	30	G 5
Grand View		B 7
Grangemont	130	C 3
Grangeville	2,544	B 4
Granite	150	B 1
Gray	15	G 6
Greencreek	51	B 3
Greenleaf		B 6
Greer	127	B 3
Grimes Pass		C 5
Grouse	43	E 6
Hagerman	520	D 7
Hailey	1,464	D 6
Hamer		F 6
Hammett	350	C 7
Hansen	463	D 7
Harpster		C 4
Harrison	322	B 2
Harvard	102	B 3
Hauser	70	B 2
Hayden Lake	39	B 2
Hazelton	429	E 7
Headquarters	300	C 3
Heath	15	B 5
Heglar	10	E 7
Heise	87	G 6
Henry		G 7
Heyburn	539	E 7
Hibbard	400	G 6
Hill City	15	D 6
Holbrook		F 7
Hollister	80	D 7
Homedale	1,411	A 6
Hope	111	B 1
Horse Shoe Bend	401	B 6
Howe	200	F 6
Huetter	84	B 2
Humphrey	35	F 5
Idaho City	246	C 6
Idaho Falls	19,218	F 6
Idahome		E 7
Indian Valley	50	B 5
Inkom	434	F 7
Iona	502	G 6
Irwin	147	G 6
Island Park		G 5
Jerome	4,523	D 7
Joseph	23	B 4
Juliaetta	365	B 3
Juniper		F 7
Kamiah	812	B 3
Kellogg	4,913	B 2
Kendrick	409	B 3
Ketchum	757	D 6
Keuterville	25	B 3
Kilgore	160	G 5
Kimberly	1,347	D 7
King Hill	260	C 6
Kingston		B 2
Kooskia	629	C 3
Kootenai	199	B 1
Kuna	534	B 6
Laclede	200	B 1
Lago	250	G 7
Lake	8	G 5
Lake Fork	11	B 5
Lakeview		B 2
Lamont	50	G 6
Lane		B 2
Lapwai	480	B 3
Lava Hot Springs	591	F 7
Leadore	159	E 5
Leesburg		D 4
Lemhi	150	E 5
Leonia		B 1
Leslie	40	E 6
Letha	376	B 6
Lewiston	12,985	A 3
Lewisville	402	F 6
Liberty	250	G 7
Lincoln	470	F 6
Lorenzo	250	G 6
Lost River	37	E 6
Lowell		C 3
Lowman	30	C 5
Lucile	13	B 4
Lund	103	G 7
Mackay	760	E 6
Macks Inn	100	G 5
Malad City	2,715	F 7
Malta	518	E 7
Marble Creek	6	C 2
Marsing	643	B 6
Marysville	190	G 5
May	75	E 5
Mayfield		B 6
McCall	1,173	C 5
McCammon	578	F 7
Meadow Creek	15	B 1
Meadows	190	B 5
Melba	203	B 6
Melrose	5	B 3
Menan	430	F 6
Meridian	1,810	B 6
Mesa	179	B 5
Middleton	496	B 6
Midvale	231	B 5
Milner		D 7
Minidoka	113	E 7
Minkcreek	124	G 7
Monteview		F 6
Montour	155	B 6
Montpelier	2,682	G 7
Moore	256	E 6
Moravia		B 1
Moreland	250	F 6
Moscow	10,593	B 3
Mountain Home	1,887	C 6
Moyie Springs	109	B 1
Muldoon		E 6
Mullan	2,036	C 2
Murphy	37	B 6
Murray	158	C 2
Murtaugh	239	D 7
Myrtle	20	B 3
Naf		E 7
Nampa	16,185	B 6
Naples	300	B 1
New Meadows	621	B 4
New Plymouth	942	B 6
Newdale	312	G 6
Nezperce	543	B 3
Nordman	18	B 1
North Fork	100	D 4
N. Pocatello	575	F 7
Norwood		C 5
Notus	313	B 6
Nounan		G 7
Oakley	684	D 7
Obsidian	11	D 6
Ola	300	B 5
Oldtown	358	A 1
Onaway	81	B 3
Orchard		B 6
Orchards	4,494	A 3
Oreana	100	B 6
Orofino	1,656	B 3
Orogrande	12	C 4
Ovid	200	G 7
Oxford	110	F 7
Pardee		B 3
Paris	774	G 7
Parker	306	G 6
Parma	1,369	B 6
Patterson	112	E 5
Paul	560	E 7
Payette	4,032	B 5
Pearl	38	B 6
Peck	170	B 3
Pegram	75	G 7
Picabo	100	D 6
Pierce	544	C 3
Pine		C 6
Pingree	102	F 6
Pioneerville	8	C 6
Placerville	17	C 6
Plano	403	G 6
Plummer	395	B 2

*No room on map for name.
†Part. See also Wyoming and Montana



IDAHO
SCALE OF MILES
0 10 20 30 40 50 60
State Capitals
County Seats
Canals
Railroads
BRITISH COLUMBIA
WASHINGTON
MONTANA
BOUNDARY
BONNER
KOOTENAI
SHOSHONE
BENEWAH
LATAH
CLEARWATER
NEZ PERCE
LEWIS
IDAHO
SPOKANE
Sandpoint
Coeur d'Alene
Wallace
Moscow
Lewiston
Grangeville
Orofino
Bonners Ferry
Missoula
Helena
Butte
Anaconda
Great Falls
Kalispell
Bozeman
Livingston
GLACIER NATIONAL PARK
BLACKFEET INDIAN RESERVATION
ROCKY MOUNTAINS
CABINET MTS.
BITTERROOT RANGE
COEUR D'ALENE MTS.



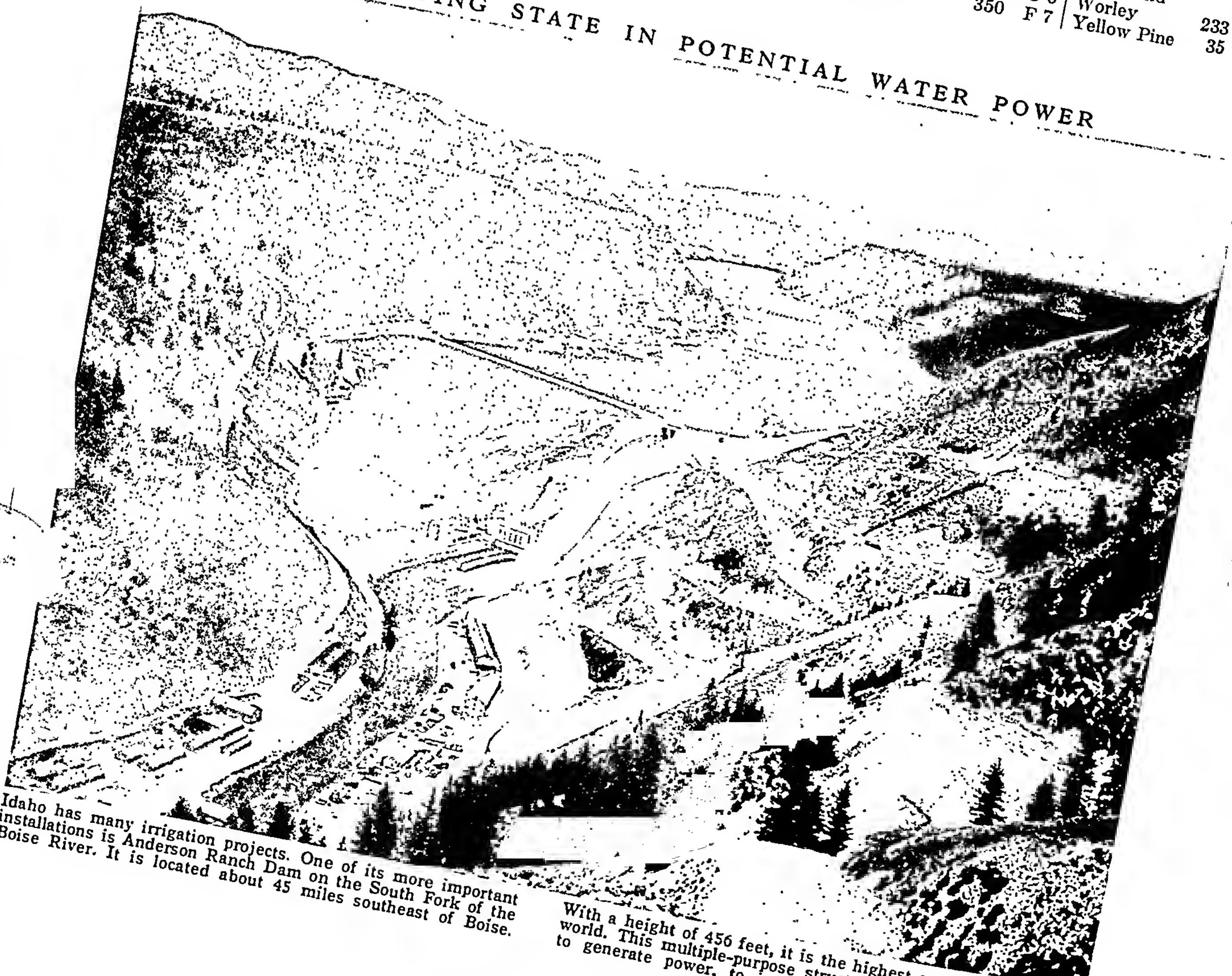
YELLOWSTONE NATIONAL PARK
Yellowstone Park
Gardiner
West Yellowstone
Yellowstone L.
Shoshone L.
Lewis L.
Heart L.
Hebgen Res.
Jackson L.
Jackson
Snake
Bedford
Smoot
Alder
Virginia City
Dillon
Armstead
Salmon
Leesburg
Carmen
Baker
Tendoy
Lemhi
Challis
Ellis
Shoup
North Fork
Patterson
Gilmore
Spencer
Humphrey
Kilgore
Macks Inn
Big Springs
Island Park
Dubois
FREMONT
CLARK
JEFFERSON
MADISON
TETON
Driggs
Tetonia
Victor
Swan Valley
Rexburg
Ashton
Marysville
Chester
St. Anthony
Parker
Terreton
Mud L.
Idaho Falls
Shelley
BONNEVILLE
Blackfoot
FORT HALL
CARIBOU
Alpine
Gray
Soda Springs
Enterprise
Joseph
Warren
Pollock
Riggins
LEMHI
CUSTER
BUTTE
BITTERROOT RANGE
BEAVERHEAD
N E V A D A
U T A H
45°
44°
43°
42°
111°
112°
113°
114°
115°
116°
5
6
7

IDAHO—*Continued*

Pocatello	26,131	F 7
Polaris	214	B 2
Pollock		B 4
Ponderay	248	B 1
Porthill	68	B 1
Portneuf	65	F 7
Post Falls	1,069	A 2
Potlatch	1,024	A 3
Prairie	150	C 6
Preston	4,045	G 7
Prichard	40	B 2
Priest River	1,592	A 1
Princeton	84	B 3
Rathdrum	610	A 2
Raymond	88	G 7
Red River Hot Springs	12	C 4
Regena	30	C 6
Reno		F 5
Reubens	116	B 3
Rexburg	4,253	G 6
Richfield	429	D 6
Riddle	35	B 7
Rigby	1,826	G 6
Riggins	287	B 4
Ririe	527	G 6
Riverside		F 6
Roberts	341	F 6
Robin	165	F 7
Rockford		F 6
Rockford Bay	27	B 2
Rockland	277	F 7
Rocky Bar		C 6
Rogerson	75	D 7
Roseberry		C 5
Roselake	212	B 2
Roswell	92	A 6
Roy	25	F 7
Rupert	3,098	E 7
Sagle	75	B 1
St. Anthony	2,695	G 6
St. Charles	363	G 7
Saint Joe	75	B 2
St. Maries	2,220	B 2
Salmon	2,648	D 4
Samaria		F 7
Samuels		B 1
Sanders	25	B 2
Sandpoint	4,265	B 1
Santa		B 2
Shelley	1,856	F 6
Shoshone	1,420	D 7
Shoup		D 4
Silver City	2	B 6
Small		F 5
Smelterville	76	B 2
Smiths Ferry		C 5
Soda Sprs.	1,329	G 7
Southwick	200	B 3
Spencer	70	F 5
Spirit Lake	823	A 2
Springfield	435	F 6
Springston	57	B 2
Squirrel		G 5
Stanley	33	D 5
Star	525	B 6
Starkey	3	B 5
State Line	52	*B 2
Sterling	80	F 6
Stibnite	717	C 5
Stites	227	C 3
Stone	170	F 7
Strevell	25	E 7
Sublett	10	E 7
Sugar City	684	G 6
Sun Valley	428	D 6
Sunbeam	6	D 5
Swan Valley	203	G 6
Swanlake	250	F 7
Sweet	200	B 6
Sweetwater	80	B 3
Taber		F 6
Tamarack		B 5
Tendoy		E 5
Tensed	189	B 2
Terreton	35	F 6
Teton	463	G 6
Tetonia	232	G 6
Thatcher	50	G 7
Thornton	300	G 6
Three Creek	65	C 7
Tindall	5	C 7
Treasureton		G 7
Triangle	35	B 7
Triumph	97	D 6
Troy	531	B 3
Tuttle	15	D 7
Twin Falls	17,600	D 7
Twin Lakes	225	B 2
Twin Springs		C 6
Tyhee	350	F 7
Ucon	356	F 6
Ustick	200	B 6
Vay	80	B 1
Victor	431	G 6
Viola	150	B 3
Virginia	245	F 7
Wallace	3,140	C 2
Wapello		F 6
Wardner	772	B 2
Warm Lake	500	C 5
Warren	30	C 4
Wayan	40	G 7
Weippe	1,000	C 3
Weiser	3,961	B 5
Wendell	1,483	D 7
Westlake	35	B 3
Weston	382	F 7
White Bird	270	B 4
Wilder	555	A 6
Wildhorse	18	B 5
Winchester	488	B 3
Winona		B 3
Winsper	62	F 5
Woodland		C 3
Worley	233	B 2
Yellow Pine	35	C 4

*No room on map for name.

A LEADING STATE IN POTENTIAL WATER POWER



Idaho has many irrigation projects. One of its more important installations is Anderson Ranch Dam on the South Fork of the Boise River. It is located about 45 miles southeast of Boise. With a height of 456 feet, it is the highest earth-fill dam in the world. This multiple-purpose structure was completed in 1950 to generate power, to irrigate farms, and to control floods.

Minerals contribute much to Idaho's wealth. Among the states, Idaho ranks first in silver and zinc and second in lead. Most of the state's production of these minerals and of copper comes from Shoshone County in the Panhandle. Gold, sand and gravel, and stone are also leading minerals. Other important mineral resources include antimony ore, clays, coal, mercury, pumice and pumicite, vanadium, tungsten, barite, and cement. Some of the nation's greatest deposits of phosphate rock are in southeast Idaho.

The products of sawmills and logging camps, beet-sugar factories, and dairies are the leading manufactures of Idaho. Other large industries in the state are lead and zinc smelting and the manufacture of gray-iron castings. Newspaper publishing is also important.

The University of Idaho is at Moscow in the north of the state. Idaho State College is located at Pocatello. The School for the Deaf and Blind is at Gooding. The College of Idaho is at Caldwell, and Northwest Nazarene College is at Nampa.

Historical Background

Idaho was for a long time included in the vast unexplored Oregon country. At that time the Kootenay, Pend d'Oreille, Coeur d'Alene, and Nez Percé tribes of Indians lived north of the Salmon River, while the Shoshone or Snakes, the Sheepeaters, and the Bannocks lived south of this stream.

The first white men known to have explored the region were Meriwether Lewis and William Clark during their expedition to the mouth of the Columbia in 1805 and 1806. After crossing the treacherous Rocky Mountain barrier through Lemhi Pass, they started down the Salmon River. Impassable rapids and falls made them turn back into Montana to seek a new trail. Going north, they crossed the Bitterroot Range through Lolo Pass, and followed the famous Lolo Trail through Idaho to the junction of the Clearwater and Snake rivers. (*See* Lewis and Clark Expedition.)

During the first decade of the 19th century, English and American fur traders established posts in Idaho. John Jacob Astor organized the Pacific Fur Company in 1809 and sent out an expedition under Wilson Price Hunt which reached this region in 1811. Hunt's party crossed the Grand Teton Pass into Idaho, and started down the treacherous Snake River in canoes. "Caldron Linn" and the "Devil's Scuttle Hole" are names given by Hunt to the rapids below the American Falls near Milner, where a member of his party was drowned. In 1821 the powerful Hudson's Bay Company entered the fur trade of this section. It built Fort Boise in 1834, and in 1836 purchased Fort Hall. Among the pioneer adventurers who entered Idaho, no one was more widely known and loved than Francis Payette, for whom a city and a river of the state were named. Captain B. L. E. Bonneville spent the years 1832–35 in exploring the Idaho region. His travels were narrated by Washington Irving in 'The Adventures of Captain Bonneville'.

A DEEP GASH IN THE EARTH'S FACE

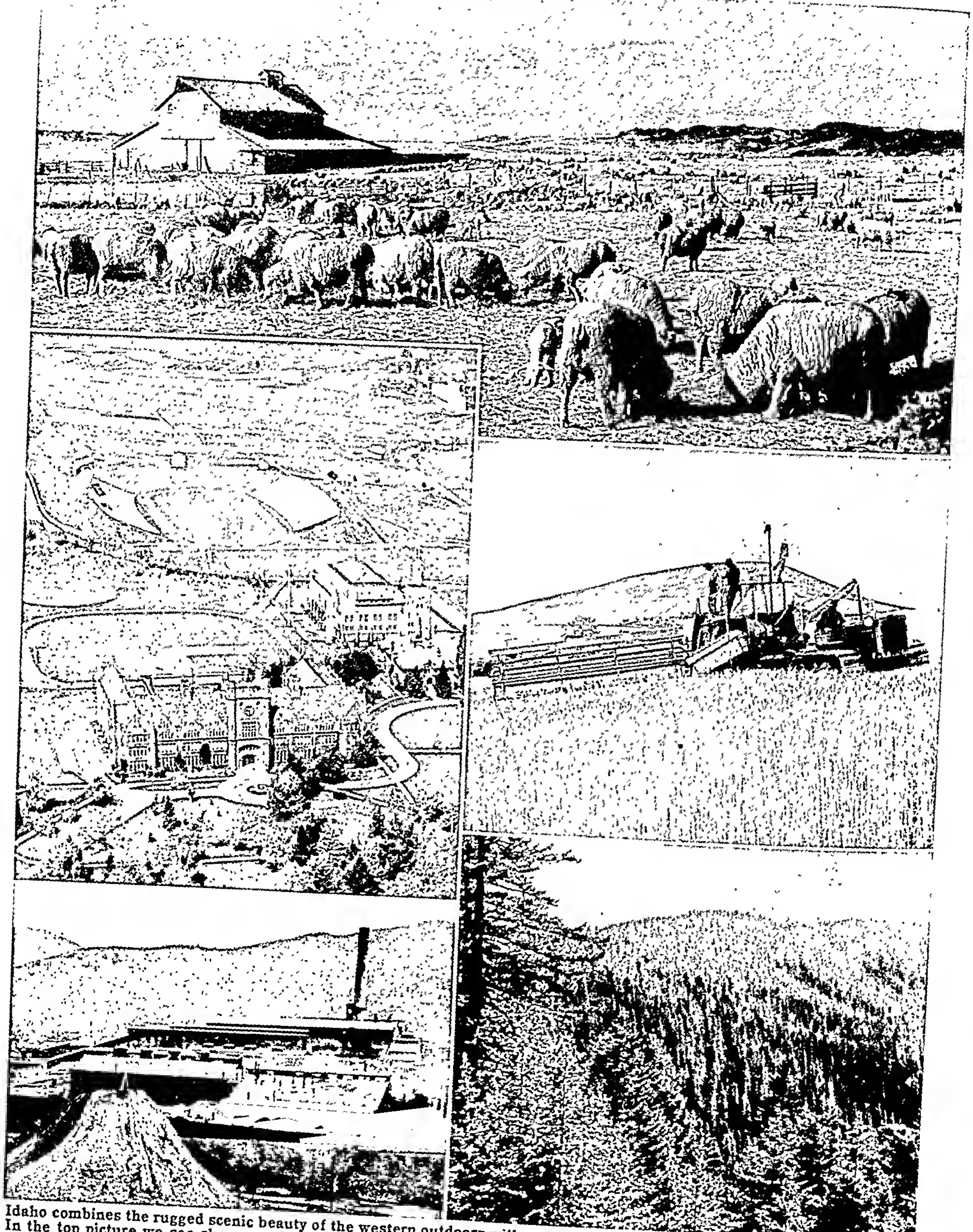
This is one of several canyons cut by the Snake River as it winds across the southern and western parts of Idaho. These canyons are among the deepest in the world; in many places their rocky walls rise thousands of feet above the river.

Following the trappers came the missionaries: Henry H. Spalding, who settled at Lapwai Creek, near the present city of Lewiston in 1836; Marcus Whitman, who continued on into what is now the state of Washington; and Father Pierre Jean de Smet, a Jesuit, who labored among the Indians of the Northwest. A small group of Mormons moved into eastern Idaho in 1855, and in 1860 founded the town of Franklin, Idaho's first permanent settlement. Others came in such numbers that a considerable part of Idaho's population today is Mormon.

A rush of miners to Idaho followed the discovery of gold on Orofino Creek in 1860. More gold was found the next year at Pierce City and in the Salmon River district. The rough Indian trails were jammed with pack trains headed for the new mining camps. In 1863 a rich placer camp opened in the Boise basin. By 1864 Idaho's population had increased to nearly 20,000. In 1863 Idaho became a territory. Montana and part of Wyoming were then within its boundaries. The creation of these two states later left Idaho with its present irregular outline. Occasional Indian outbreaks harassed the early Idaho settlers, but by about 1880 most of the Indians had been removed to reservations.

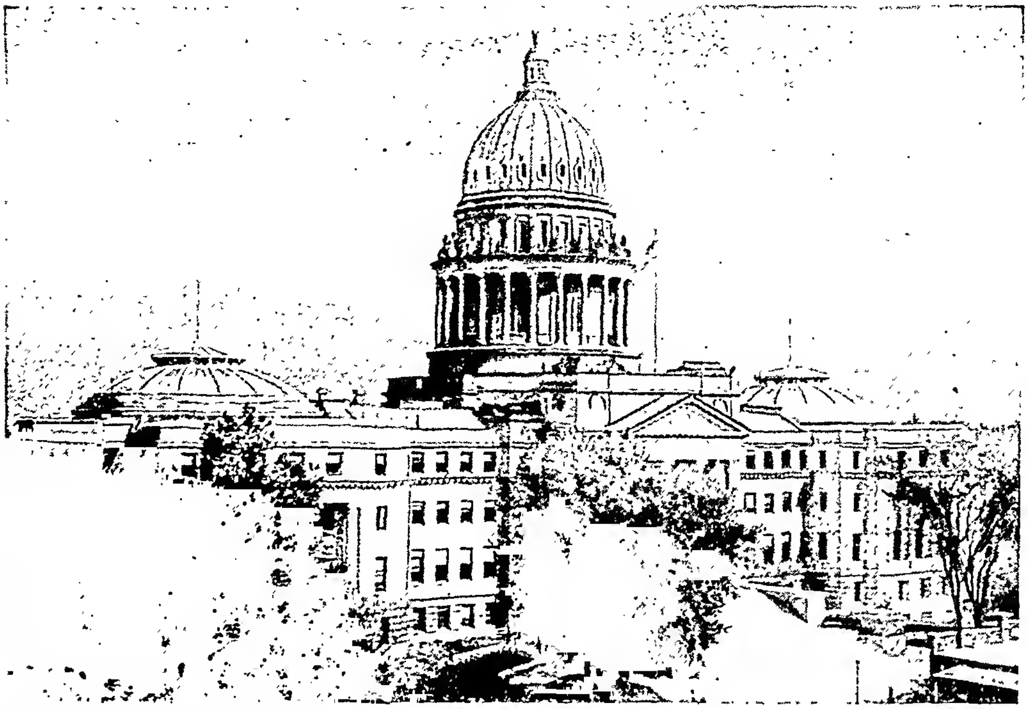
Idaho was admitted as a state in 1890. Although it doubled its population in every decade from 1870 to 1910, it is still only thinly settled. Twice the size of Ohio, it has less than one tenth the population. Only about 9 per cent of the state's area has been put under cultivation.

LAND OF BEAUTY AND PRODUCTIVENESS



Idaho combines the rugged scenic beauty of the western outdoors with great natural resources that foster a vigorous culture. In the top picture we see sheep grazing on a ranch in the rolling country in the southern part of the state. In the center (left) is a view of the stadium, gymnasium, and one of the main buildings on the campus of the University of Idaho at Moscow. To the right a combine moves through a sea of wheat. Below (left) is a lead and zinc smelting plant in the vast mineral storehouse surrounding Coeur d'Alene in the north. At the right is part of one of Idaho's 17 national forests.

THE STATE CAPITOL AT BOISE



Boise, the capital of Idaho, stands on the site of a former fur trading post of the Hudson's Bay Company. A United States military post was established here in 1863. In the following year the city was organized as the capital of the Idaho Territory. The handsome Capitol Building, which was completed in 1920, is made of Idaho sandstone and Vermont marble.

The lack of transportation between the settled northern and southern sections, which is due to mountain barriers, has been a great handicap. Four main railroads cross Idaho from east to west, but travel by rail from north to south still carries one through Oregon and Washington. An automobile highway, however, now links the north and south boundaries.

Politically, Idaho has been distinguished for its progressiveness. It gave the franchise to women in 1896; introduced the initiative, referendum, and recall in 1912; state-wide prohibition in 1916; and set up state liquor dispensaries in 1935. The constitution, adopted in 1890, reserves all the waters of the state for public use. The executive department consists of a governor, lieutenant governor, secretary of state, treasurer, and others, all elected for four-year terms.

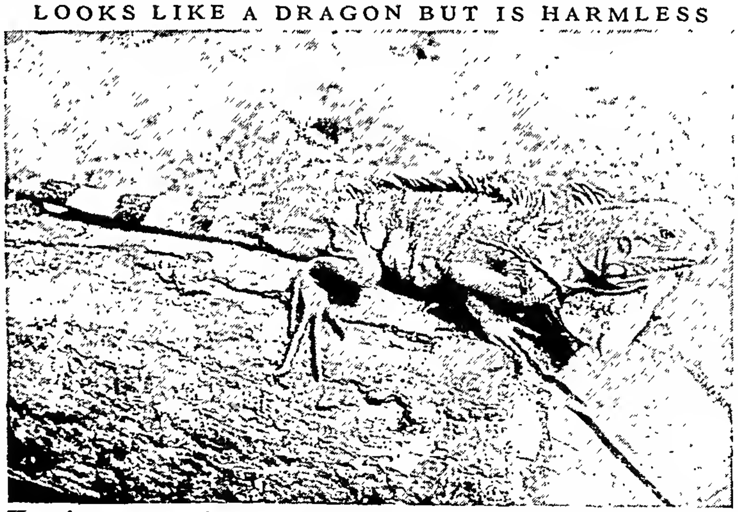
Several serious mining strikes have disturbed the state. In a strike in 1905, ex-Governor Frank Steunenberg was assassinated. (*See also* chronology in Idaho Fact Summary.)

Boise, the capital, is on the Boise River, in the southwest. It is the financial and shipping center for southern Idaho and eastern Oregon. Its industries are built on the region's lumber, agriculture, and mining (*see* Boise). Pocatello is the second largest city. Railroad shops and irrigation promoted its growth. An atomic reactor testing station is between Arco and Idaho Falls. (*See also* United States, section "Rocky Mountains.")

IGUANA (*ĭ-gwä′na*). This family of lizards, varying widely in appearance and habits, is confined to the Western Hemisphere, except for two genera in Madagascar and one in the Fiji and Tonga islands. They have curious teeth, sawlike at the tips; a large pouch, or dewlap, under the head and neck; and a scaly crest all along the back. Most of them are green. Some assume the color of their surroundings, thus making themselves difficult to see (protective coloration). They usually live in trees or in burrows.

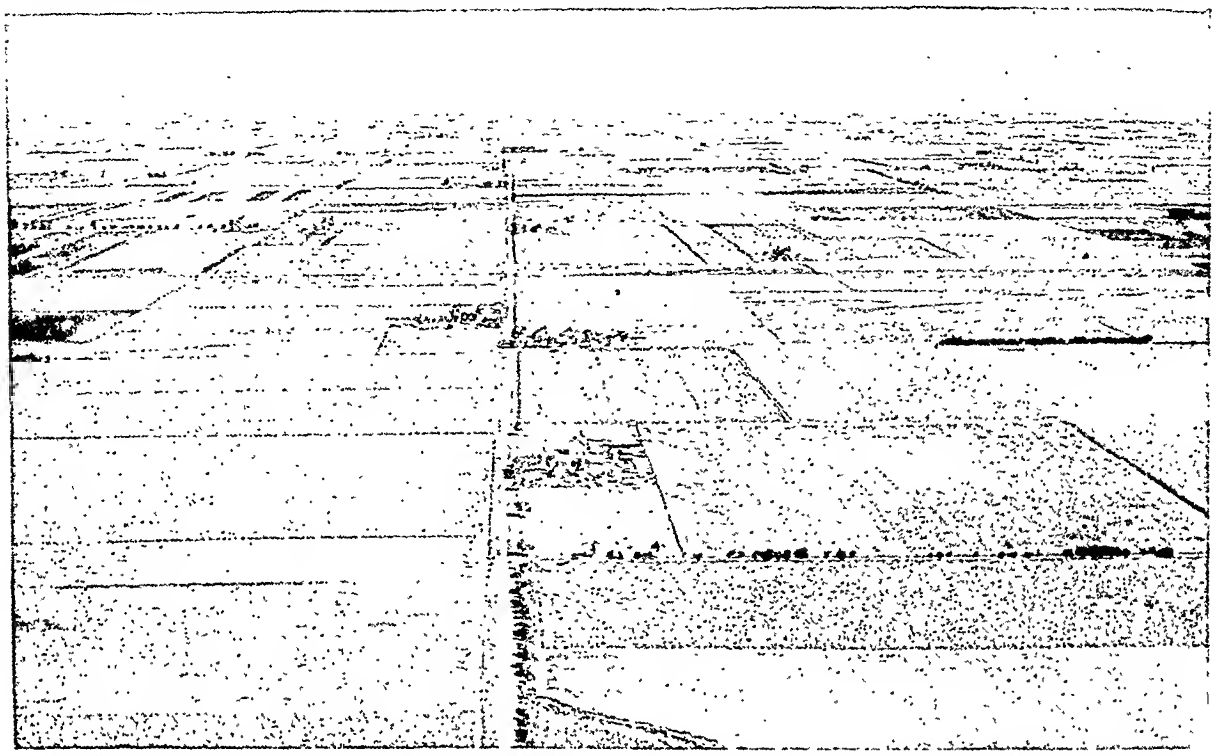
Included in the family are the chameleons of the southwestern United States (*see* Chameleon). The common iguana of Central and South America grows six feet long and weighs up to 30 pounds. It lives in trees, where it sprawls out on a horizontal branch with its legs dangling. It feeds on leaves and other plants. The Galápagos marine iguana, four to five feet long, basks on rocky shores and swims with strong strokes of its tail to feed on seaweeds. (For picture, *see* Galápagos Islands). The Galápagos land iguana eats berries and cactus. The rhinoceros iguana of Hispaniola has three horns on its snout. Even uglier, though as harmless as other iguanas, is the helmeted basilisk of Central America. (*See also* Lizards.)

LOOKS LIKE A DRAGON BUT IS HARMLESS



Here is a common iguana, taking its ease on top of a log. Many Latin Americans find this creature's flesh quite a delicacy because, when cooked, it is similar to the white meat of chicken.

The "PRAIRIE STATE" *and Its Rich* FARM LANDS



In this Fairchild air view we see the straight roads, regular fields, and flat land that characterize Illinois, heart of the Middle West. The "Prairie State" has a great number of small towns—a good sign of well-distributed farm prosperity.

ILLINOIS. From a happy hunting ground of the Indians to one of the busiest sections of North America is the story of Illinois. In less than three centuries French trading posts have become great cities, and today the "Prairie State" ranks among the leading industrial regions of the world.

Illinois stands near the middle of the continent. The center of population of the United States shifted to southeastern Illinois in 1950. The state's chief city, Chicago, is the metropolis of the Middle West and the second city in size in the nation. Transportation lines center here and give Illinois more miles of railway than any other state except Texas.

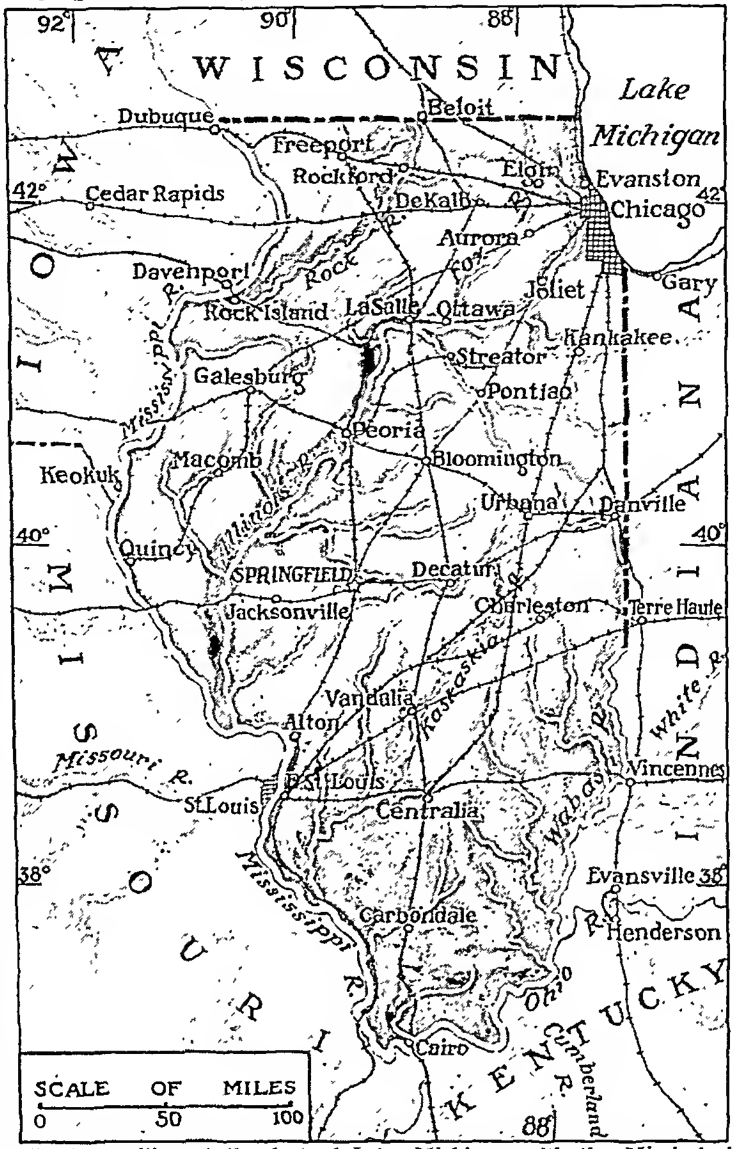
In addition to its advantages of position, the state is rich in natural resources. It has abundant supplies of bituminous coal and petroleum for its manufacturing and transportation system. Almost the entire state is covered with rich and well-watered lands that make it usually second only to Iowa in corn production, first in soybeans, and third in the production of oats. It also raises hogs, cattle, and sheep in large numbers, and sends many of them to Chicago, the greatest meat-packing center in the world.

The most remarkable feature about Illinois is that it stands very high in agriculture, manufacturing, mining, and trade. It ranks fourth among the states in total cash income received by farmers, surpassed only by Iowa, California, and Texas. It also ranks fourth in the value added to goods by its manufacturing industries, and it ranks seventh in the total worth of its mineral production. The leading minerals are bituminous coal and petroleum. The state is second in rank in wholesale trade, fourth in retail trade, and third in service trade.

With its gradually sloping hills and broad shallow valleys, Illinois is one of the most level states in the country. The only extensive region with many hills is about 50 miles from the southern boundary, where a narrow branch of the Ozark Mountains crosses the state. In the northwest the state reaches its greatest height in hills that rise some 1,200 feet above sea level; but even these are only a few hundred feet above the surrounding country. From north to south the surface of the land as a whole slopes gently to the lowest point (279 feet above sea level) along the Mississippi River in the Cairo area.

If a relief map of Illinois shows a land of no mountains, it shows one well covered with rivers. On the east the state touches the vast "unsalted seas" of the Great Lakes. On the west and south it borders for hundreds of miles on two of the greatest navigable rivers of the United States—the Mississippi and the Ohio; and on the east, separating its southern half from Indiana, is the Wabash. The interior is equally well watered by more than 275 streams in two river systems. Three-fourths of the streams empty into the Mississippi system while the others are tributaries of the Wabash and Ohio rivers. The major river inside the state is the Illinois. This stream, formed by the junction of the Des Plaines and Kankakee,

A STATE COVERED WITH FERTILE FARMS



Illinois' position at the foot of Lake Michigan, with the Mississippi River for its western boundary, makes the state a natural avenue of commerce. This, added to the richness of its farm lands and the vastness of its mineral resources, explains its great prosperity.

drains almost half the state. The early French explorer Father Marquette wrote of it: "We have seen nothing like this river for the fertility of the land, its prairies, woods, and wild cattle. It has many little lakes and tributary rivers."

All along the Illinois and other rivers of the state are bluffs of considerable height and steepness, the most noted of which is Starved Rock which rises from the Illinois River opposite Utica. The view of the countryside from the top of this mammoth rock, 140 feet above the river, with its numerous wooded ravines and canyons extending far up and down the river, is impressive in its beauty. The spot is also rich in historic lore. Here the intrepid explorer La Salle built Fort St. Louis as a link in a chain of French fortifications, and here, in after years—if tradition is to be believed—perished the last remnant of the Illinois Indians. Their foes drove them to the flat top of the rock, and there all but a few died of hunger. The district has been made into Starved Rock State Park.

Another Illinois state park of historic interest is New Salem, overlooking the Sangamon River. This is the village where Lincoln lived for six years before going to Springfield in 1837. In 1880 the last log cabin in the town crumbled to the ground. But today New Salem has been almost completely restored, including the store where Lincoln worked, the Rutledge Tavern where he lived, and the cooper shop where he studied at night. These and many other buildings have been authentically furnished.

Other historic sites that have been made into state parks are Fort Massac on the Ohio River, where George Rogers Clark landed on his way to capture Kaskaskia; Fort Chartres, on the Mississippi, built by the French in the 1700's; Cahokia Mounds, near East St. Louis, with 80 mounds left by early Indians. White Pines Forest State Park, 90 miles west of Chicago, preserves the southernmost stand of white pine in the Middle West.

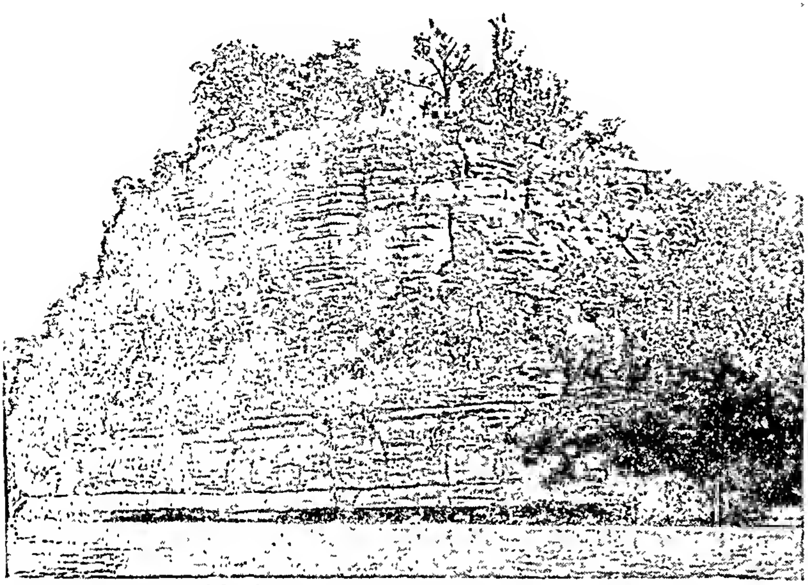
Illinois Prairies

When the early explorers penetrated Illinois the treeless plains resembled billowy seas of tall grass and beautiful flowers. Forests were found only in the *southern part and* bordering the rivers in the north. Today both forests and prairies have yielded to the plow, and there is nothing to suggest the name that Illinois still holds—the "Prairie State." Almost 60 per cent of its land is under cultivation. One may travel for miles and see nothing but ample farms with comfortable farmhouses and prosperous middle-sized communities.

These level and extremely fertile farming lands will always be a great, enduring source of the state's wealth. The plow may run for miles without touching a pebble or scarcely a grain of sand. A belt of rich black loam across the middle of the state ranks among the finest soils in the world. The gentle slopes and fine soil have invited the introduction of machinery, making large farms possible and enormously increasing the production. In some places the flatness of the land was formerly a handicap, because of poor drainage. Now tile drains and ditches remove this difficulty in these areas and make the lands some of the most valuable in the "corn belt." Illinois is one of the leading states in the Union in its acreage of drained land.

Climate and soil permit also the growing of nearly every crop known in the temperate belt. Even cotton and tobacco are grown to a small extent in "Little Egypt," around Cairo, where conditions resemble those in Kentucky and Arkansas. But by far the most valuable of the Illinois crops is corn, grown chiefly in the north and central parts of the state. For a number of years Illinois ranked first in corn

HERE STOOD A FORT BUILT BY LA SALLE



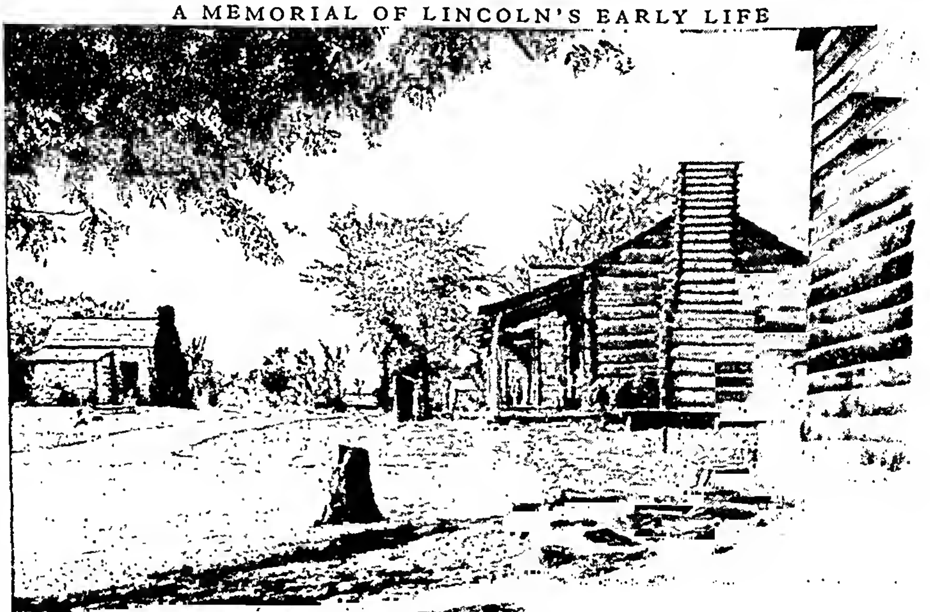
This is famed Starved Rock on the Illinois River, where La Salle built Fort St. Louis. Here too the last remnants of the Illinois Indians are said to have died of starvation on the rock's summit, where they had taken refuge from their enemies, the Potawatomis.

production, but in recent years Iowa has usually been first both in yield and in value. Together Illinois and Iowa produce about one-third of the corn raised in the United States. Wheat is grown extensively in the southern part of the state, and hay and oats are abundant in the north, where dairying is an important industry. Most of the oat and hay crops are grown to feed the horses, hogs, and cattle raised on Illinois farms. Corn is also used to feed livestock and to make corn sugar and other corn products. Garden produce is raised extensively near the large cities, and apples and strawberries are grown in every county.

Coal and iron, two of the most important minerals in the world, are both readily available to Illinois. Coal is mined from the enormous bituminous deposits which underlie most of the state. And Great Lakes shipping places the rich Lake Superior iron-ore region within easy reach. Another valuable mineral is petroleum, in central and southern Illinois. Natural gas and its liquids are also produced. Clay for brick and tile is found in nearly every county. The abundant limestone is extensively used in manufacturing portland cement. Illinois leads the states in mining fluorspar, used chiefly in smelting iron. Zinc and lead are mined in the north. Stone, sand and gravel, and lime are also important minerals.

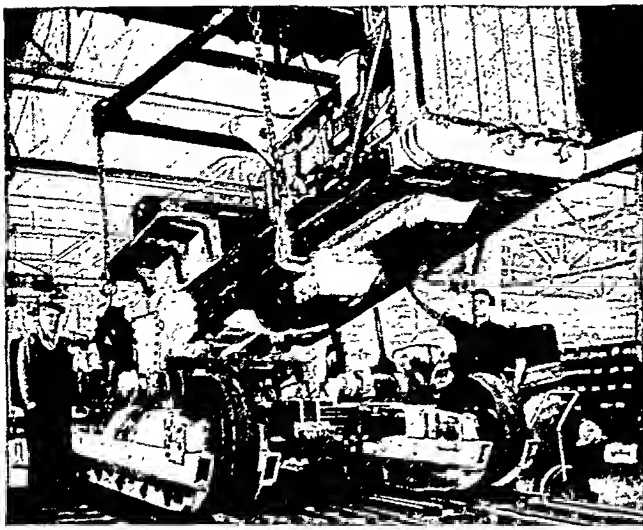
Manufactures and industry on an enormous scale are the result of the cheap and plentiful coal, combined with easily accessible iron. In 1847 Cyrus McCormick established his reaper (harvester) factory in Illinois. Today there are few places in the civilized world that do not use agricultural implements made in Illinois. The manufacture of tractors and other farm machinery has become the most valuable single industry in the state. Illinois leads all other states in this production. Blast furnaces and steel mills also account for a large part of the state's total manufacturing. Most of the large steel mills are in the southeastern part of Chicago.

A MEMORIAL OF LINCOLN'S EARLY LIFE



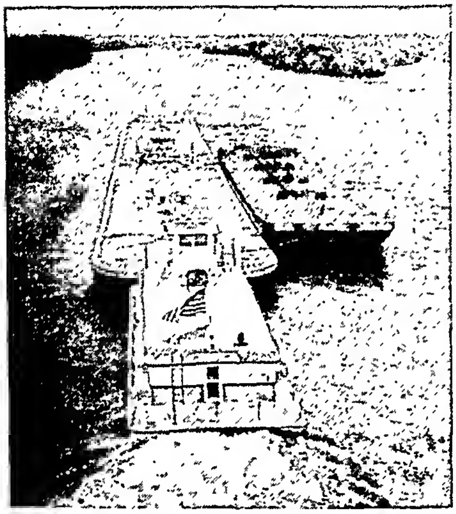
This is a view of New Salem, the small pioneer village which was restored as an Illinois shrine. As a young man, Abraham Lincoln lived here for six years. It was here that he clerked in a grocery store, studied law, began his political career, and fell in love with Ann Rutledge. From this village Lincoln went to Springfield in 1837 to enter the practise of law.

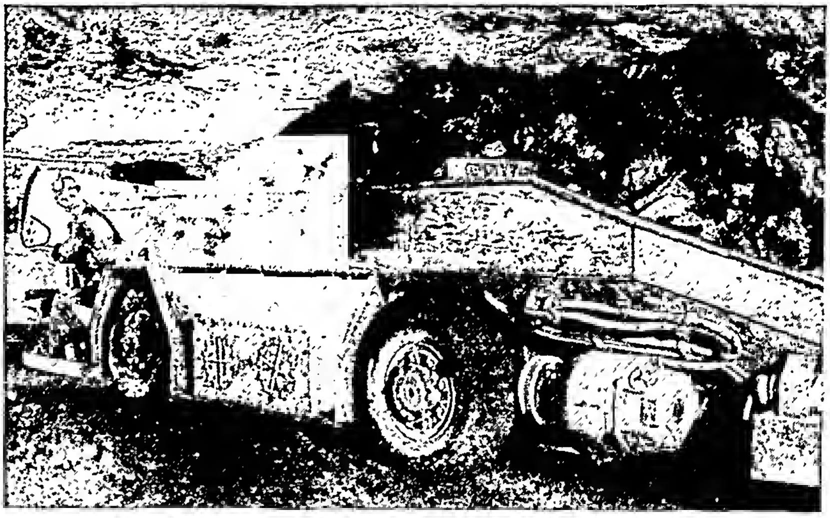
ABUNDANCE FROM FACTORY, MINE, AND FARM



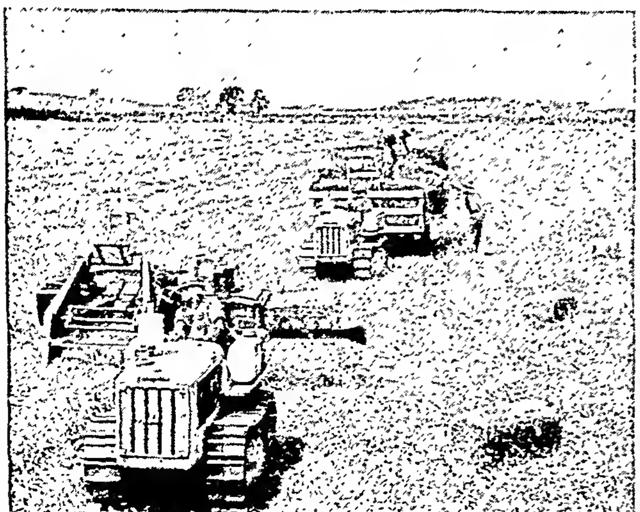
Illinois leads the world in the manufacture of farm machinery. Here workmen lower a giant tractor onto its caterpillar tracks.

The world's largest packing house is in Chicago. On this hog line, government inspectors examine head and throat glands.

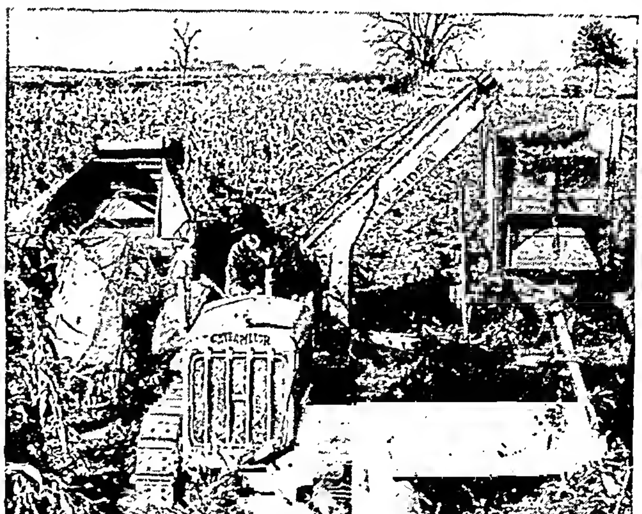




Depicted here are the two most important minerals of this high-ranking mineral-producing state. The powerful diesel towboat pushes oil barges on the Illinois waterway, while the massive shuttle car hauls a seven-ton load of coal from a working face.

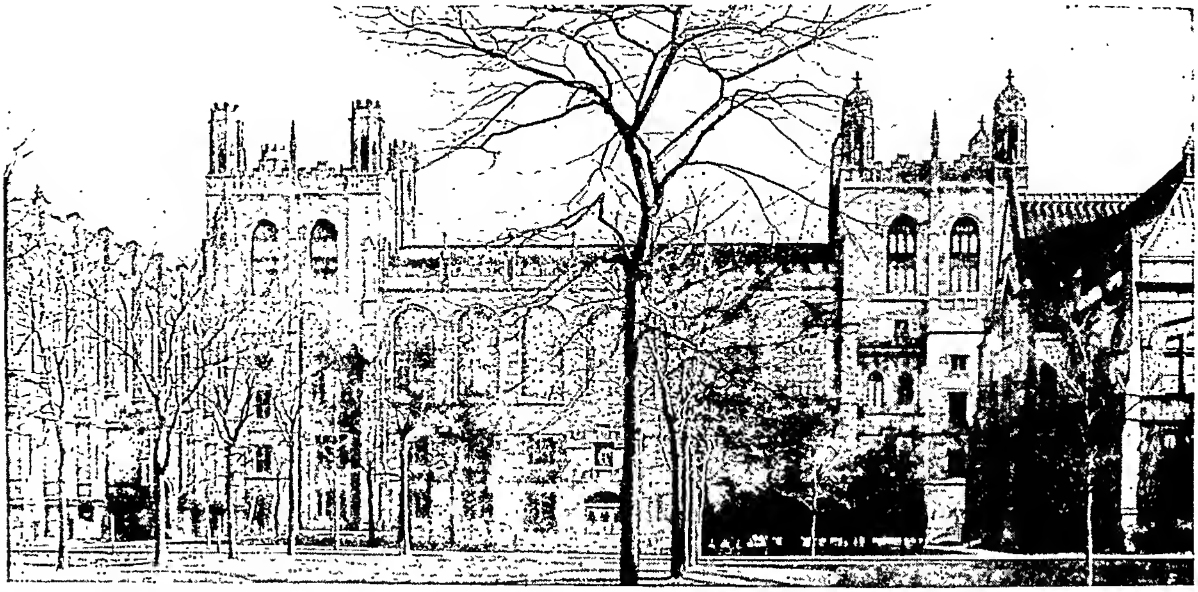


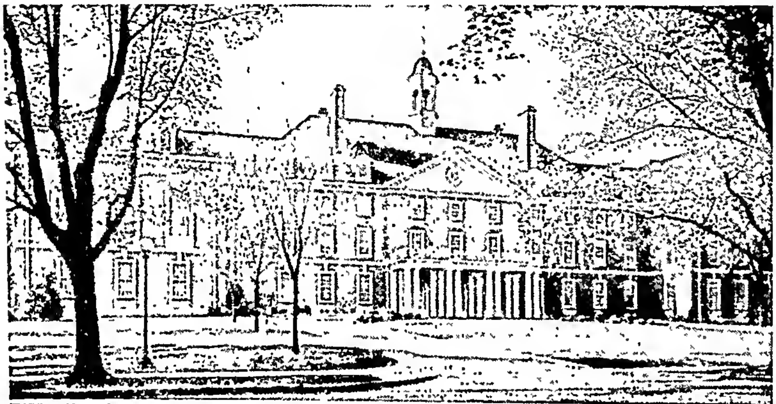
The diesel tractors pull an automatic oat straw baler and a hayrack. Oats are an important crop in the Prairie State.

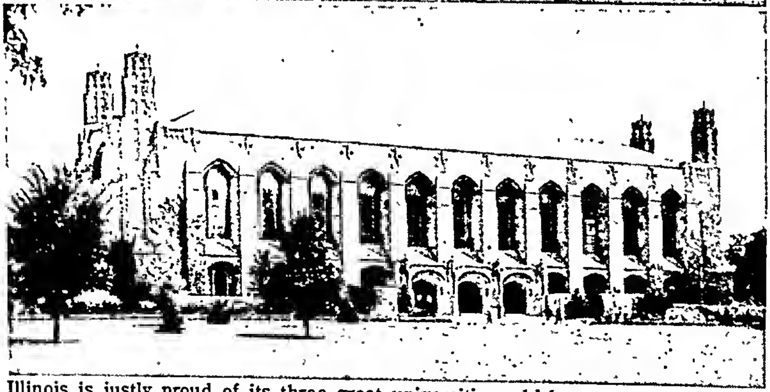


Illinois is a leading corn producer in the corn belt. Such machines as this picker-husker help it to maintain its high output.

THREE OF THE NATION'S FINEST UNIVERSITIES







Illinois is justly proud of its three great universities, which are numbered among the country's leading institutions of higher learning. At the top is Harper Memorial Library of the University of Chicago. In the center is the Student Union building of the University of Illinois at Urbana. At the bottom is Deering Library of Northwestern University, on the shore of Lake Michigan in Evanston, a suburb of Chicago.

Another huge industry is meat packing. Chicago's stockyards and packing houses are the world's greatest (*see* Chicago). Illinois also ranks first in the manufacture of confectioneries and electrical machinery.

Illinois is important in commerce too. Its central location, its level surface, and the forced direction of railroads around the southern end of Lake Michigan account for the number of railroads in the state. Illinois also is well located for inland water transportation. On Lake Michigan it has harbors at Waukegan and in the Chicago and Calumet rivers. In 1954 Congressional approval of United States participation with Canada in the St. Lawrence Seaway Project gave promise of making Chicago an ocean port. The Mississippi, Ohio, and Wabash rivers are navigable for more than 800 miles.

Within the state the chief river is the Illinois. It is navigable for 291 miles from its mouth at Grafton, on the Mississippi. The Illinois and Michigan Canal was opened in 1848 to link the Illinois River to Lake Michigan at Chicago. It was superseded in 1900 by the Chicago Sanitary and Ship Canal, built chiefly to carry away the sewage of Chicago and prevent pollution of Lake Michigan. This canal extended to Lockport, near Joliet. In 1933 the deepening of the Illinois to Grafton was completed and the 327-mile water highway from Chicago to the Mississippi became known as the Illinois Waterway. The Illinois and Michigan Canal Parkway now extends along the old canal from Channahon to Utica. It includes a series of picturesque recreational parks.

Cities on the Prairies

More than half the people of Illinois live in the metropolitan area about Chicago. This area comprises five counties in Illinois and one in Indiana in addition to the "windy city" and contains about 5½ million

Continued on page 40

Illinois Fact Summary

ILLINOIS (Ill.): Name from Algonquian Indian word for "men," *Iliniwek.* French changed ending to *ois.*

Nickname: "Prairie State." Sometimes called "Sucker State," comparing migration of sucker fish with that of lead and zinc miners to Galena in spring and back home in fall.

Seal: American eagle with scroll in beak perches on rock; sun rises over prairie on distant horizon.

Motto: State Sovereignty—National Union.

Flag: For description and illustration, *see* Flags.

Flower: Native violet. **Bird:** Cardinal. **Tree:** Native oak. **Song:** 'Illinois'—words, Charles H. Chamberlain; music, Archibald Johnston.

THE GOVERNMENT

Capital: Springfield (since 1837).

Representation in Congress: Senate, 2. House of Representatives, 25. Electoral votes, 27.

General Assembly: Senators, 51; term, 4 yrs. Representatives, 153; term, 2 yrs. Convenes Wed. after 1st Mon. in Jan. in odd yrs. Session limit: 6 mos.

Constitution: Adopted 1870. Amendment must be (a) passed by two thirds of legislature and (b) ratified by majority of voters at the election or by two thirds of those voting on the amendment, whichever is smaller.

Governor: Term, 4 years. May succeed himself.

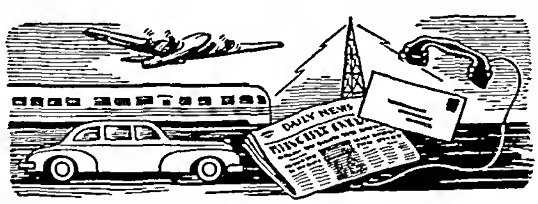
Other Executive Officers: Lieut. gov., secy. of state, atty. gen., treasr., auditor; all elected; terms, 4 yrs.

Judiciary: Supreme court—7 justices, elected by districts; term, 9 years. Appellate courts—4; 3 circuit court judges appointed for each court by supreme court; term, 3 years. Circuit courts—17 downstate; 3 judges (4 in counties of 350,000 or more inhabitants) elected in each; term, 6 years. Cook County has its own courts. County court in each county.

County: 102 counties. Governed by board of supervisors, 1 elected from each township, or board of 3 commissioners, elected by county at large; terms, 3 years. Cook county: board of 15 commissioners, 10 elected from Chicago, 5 from townships; term, 4 years.

Municipal: Mayor-council plan most common; other cities have commission or city-manager plans.

Voting Qualifications: Age, 21; residence in state, 1 year; in county, 90 days; in district, 30 days.



TRANSPORTATION AND COMMUNICATION

Transportation: Railroads, 11,600 miles. First railroad, Ill. & St. Louis (along Mississippi R. near St. Louis, Mo.), 1837. Rural roads, 103,400 miles. Airports, 169.

Communication: Periodicals, 712. Newspapers, 811. First newspaper, *Illinois Herald*, Kaskaskia, 1814. Radio stations (AM and FM), 118; first station, WDZ, Tuscola, licensed March 17, 1921. Television stations, 10; first station, WBKB, (now WBBM-TV), Chicago, began operation Sept. 6, 1946. Telephones, 3,377,300. Post offices, 1,443.

THE PEOPLE AND THEIR LAND

Population (1950 census): 8,712,176 (rank among 48 states—4th); urban, 77.6%; rural, 22.4%. Density: 155.8 persons per square mile (rank—10th state).

Extent: Area, 56,400 square miles, including 465 square miles of water surface (23d state in size; 22d state if Great Lakes area of 1,526 square miles is added).

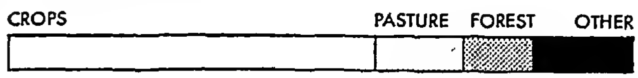
Elevation: Highest, Charles Mound, 1,241 feet, near Scales Mound; lowest, along Mississippi River in Alexander County, 279 feet.

Temperature (°F.): Average—annual, 53°; winter, 30°; spring, 52°; summer, 74°; fall, 55°. Lowest recorded, −35° (Mount Carroll, Jan. 22, 1930); highest, 115° (Greenville, July 12, 1936, and other locations and earlier dates).

Precipitation: Average (inches)—annual, 37; winter, 6; spring, 11; summer, 11; fall, 9. Varies from about 46 in southeast to about 32 in northeast.

Natural Features: Level or rolling prairies with part of the Ozark Ridge in the extreme south; low hills in the north. Principal rivers: Embarrass, Illinois, Kaskaskia, Little Wabash, and Rock. Lake Michigan at northeastern boundary. Mississippi River forms western boundary, and Ohio River the southern boundary.

Land Use: Cropland, 59%; nonforested pasture, 14%; forest, 11%; other (roads, parks, game refuges, wasteland, cities, etc.), 16%.



Natural Resources: *Agricultural*—rich soil; ample precipitation. *Industrial*—coal, petroleum, stone, sand and gravel, cement. *Commercial*—position on Lake Michigan; navigable waterways composed of Mississippi, Ohio, and Wabash rivers and Illinois River Waterway.

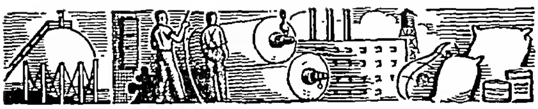
OCCUPATIONS AND PRODUCTS

What the People Do to Earn a Living

Major Industries and Occupations, 1950

Fields of Employment	Number Employed	Percentage of Total Employed
Manufacturing	1,135,955	32.2
Wholesale and retail trade	691,219	19.5
Transportation, communication, and other public utilities	333,961	9.4
Professional services (medical, legal, educational, etc.)	281,587	7.9
Agriculture, forestry, and fishery	252,573	7.1
Personal services (hotel, domestic, laundering, etc.)	182,544	5.1
Construction	173,880	4.9
Finance, insurance, and real estate	138,715	3.9
Government	133,149	3.8
Business and repair services	95,092	2.7
Mining	43,652	1.2
Amusement, recreation, and related services	33,363	0.9
Workers not accounted for	50,361	1.4
Total employed	3,546,051	100.0

Illinois Fact Summary



What the People Produce

A. Manufactured Goods (Rank among states—4th)
Value added by manufacture* (1952), $9,309,363,000

Leading Industries in 1947 (with Principal Products)	Value Added by Manufacture	Rank among States
MACHINERY (EXCEPT ELECTRICAL) Tractors and farm machinery; metalworking machinery; general industrial machinery	$1,096,146,000	2
FOOD AND KINDRED PRODUCTS... Confectioneries; meat packing; bakery products; distilled liquors; prepared meats	1,010,268,000	1
ELECTRICAL MACHINERY........ Radios and related products; telephone and telegraph equipment	669,755,000	1
FABRICATED METAL PRODUCTS... Metal stamping and coating; cutlery, hand tools, hardware	626,014,000	2
PRIMARY METAL INDUSTRIES.... Blast furnace, steel mill, and iron and steel foundry products	557,712,000	3
PRINTING AND PUBLISHING......	541,841,000	2

*For explanation of value added by manufacture, *see* Census.

B. Farm Products (Rank among states—4th)
Total cash income (1952), $2,015,238,000

Products	Amount Produced (10-Year Average)	Rank within State*	Rank among States†
Corn...........	429,440,000 bu.	1	2
Hogs...........	2,099,199,000 lbs.	2	2
Cattle.........	859,554,000 lbs.	3	7
Milk...........	2,523,000,000 qts.	4	6
Soybeans.......	68,424,000 bu.	5	1
Oats...........	143,533,000 bu.	6	3
Eggs...........	212,000,000 doz.	7	6
Hay............	3,987,000 tons	8	8
Wheat..........	28,879,000 bu.	9	13
Chickens.......	169,695,000 lbs.	10	4

*Rank in dollar value †Rank in units produced

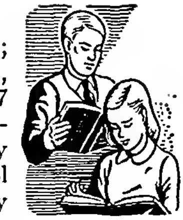
C. Minerals (Fuels, Metals, and Stone)
Annual value (1951), $489,933,000
Rank among states—7th

Minerals (1951)	Amount Produced	Value
Coal.................	54,200,000 tons	$220,548,000
Petroleum............	60,243,000 bbls.	166,870,000
Stone................	19,299,000 tons	23,475,000
Cement...............	8,377,000 bbls.	19,853,000
Sand and gravel......	20,131,000 tons	19,146,000

D. Trade

Trade (1948)	Sales	Rank among States
Wholesale..........	$18,326,663,000	2
Retail.............	8,805,257,000	4
Service............	1,051,229,000	3

EDUCATION



Public Schools: Elementary, 1,940; secondary, 344; unit (grades 1–12), 323. Compulsory school age, 7 through 16. Supt. of public instruction elected, 4-year term. County supts. elected, 4-year terms. School boards in cities and towns, mostly elected, appoint supts. of schools.

Private and Parochial Schools: 1,046.

Colleges and Universities (accredited): Colleges, 50; junior colleges, 18. State-supported schools include the University of Illinois at Urbana, with an undergraduate division in Chicago; Southern Illinois University, Carbondale; 4 state teachers colleges, at Charleston, DeKalb, Macomb, and Normal.

Special State Institutions: Lincoln State School, Lincoln; Illinois Braille and Sight-saving School, Jacksonville; Illinois School for the Deaf, Jacksonville; Dixon State School, Dixon; Illinois Soldiers' and Sailors' Children's School, Normal; Illinois Children's Hospital School, Chicago.

Libraries: City and town public libraries, 396; county libraries, 2; district libraries, 1. State library, under secretary of state, aids in developing public libraries. Work headed by ass't state librarian. Consultants for public and institution libraries and archives. State Dept. of Education aids in developing school libraries; work headed by director of school libraries. Noted special libraries: Newberry Library, John Crerar Library, Ryerson Library, Art Institute, all in Chicago; Illinois State Historical Library, Springfield.

Outstanding Museums: Art Inst., Chicago Historical Soc., Chicago Natural History Mus., Oriental Inst. of the University of Chicago, Mus. of Science and Industry, all in Chicago; Illinois State Mus., Springfield.

CORRECTIONAL AND PENAL INSTITUTIONS

State Training School for Boys, St. Charles; State Training School for Girls, Geneva; State Reformatory for Women, Dwight; State Farm, Vandalia; Illinois State Penitentiary—3 branches, Joliet-Stateville, Menard, Pontiac; Illinois State Reformatory, Sheridan.

STATE PARKS*†

Black Hawk—oldest park in the Middle West; site of Indian feasts and games; now a recreational area (12).
Buffalo Rock—sandstone bluff above Illinois R. (13).
Cahokia Mounds—remains of prehistoric race (27).
Cave-In-Rocks—cliffs on Ohio R.; huge cave; south of (31).
Fort Chartres—first built 1720; south of symbol (28).
Fox Ridge—deeply cut ravines (23).
Giant City—"Old Stone Fort" of Indian origin, most probably a buffalo trap; fantastic rock formation (30).
Grand Marais—water and other sports; south of (27).
Jubilee College—among nation's earliest colleges (15).
Kickapoo—reforested strip-mined area (18).
Lincoln Log Cabin—reconstructed cabin of Lincoln's father, Thomas, and his stepmother, Sarah (23).
Lowden Memorial—near Oregon; Lorado Taft's Blackhawk Monument rises above Rock River (4).
Matthiessen—natural preserve for wild flowers, birds, and deer; Devil's Paint Box, geologic wonder (13).
Mississippi Palisades—Indian Head cliff; valleys (5).
Nauvoo—in area rich with Mormon and Icarian (French Communist) associations; Joseph Smith Homestead, Mansion House, Icarian Apartment Houses nearby (16).

*Numbers in parentheses are keyed to map.
†There are 42 state parks in Illinois; 20 are given here.

Illinois Fact Summary

New Salem—authentic restoration of town where Abraham Lincoln lived (1831–37) (19).
Pere Marquette—the French priest, who with Joliet explored Mississippi and Illinois river areas, used this place as a camp site (24).
Spitler Woods—foot trails through virgin forests (21).
Starved Rock—unusual rock formations; site of Fort St. Louis, built by LaSalle in 1682 (13).
White Pines Forest—virgin pines (6).

STATE FORESTS*

Henderson—1,050 acres (14).
Mason—5,507 acres (17).
Union—3,521 acres (33).

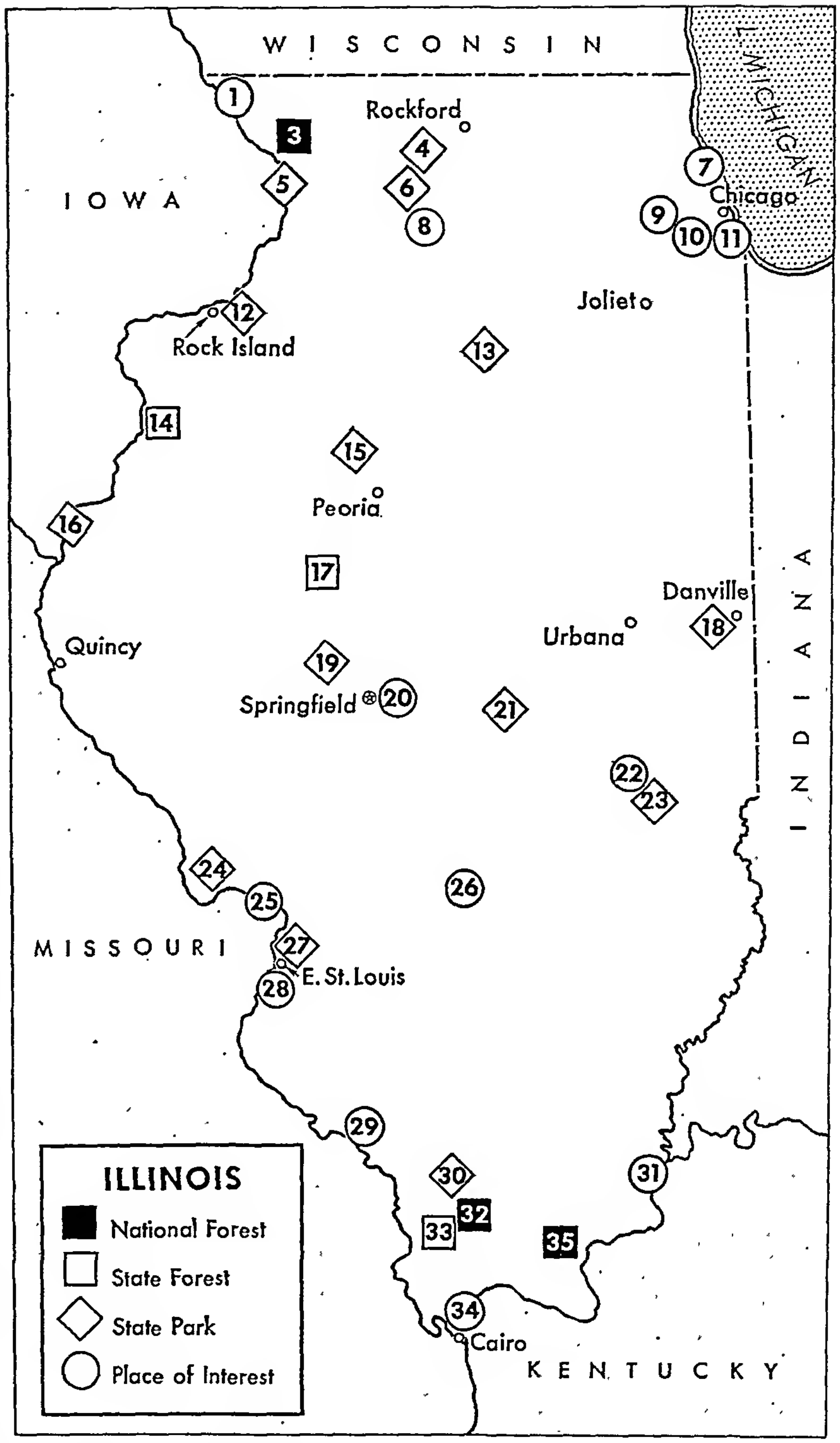
NATIONAL FORESTS*

Bellevue - Savannah — 10,710 acres; headquarters, Winona, Minn. (3).
Shawnee—801,944 acres; headquarters, Harrisburg (32, 35).

PLACES OF INTEREST*

Baha'i House of Worship—Wilmette; nine-sided building; nine represents "perfection" in Baha'i faith (7).
Cahokia—first permanent settlement in Mississippi Valley 1699 (28).
Camp Defiance—Cairo; site of Grant's headquarters during Civil War (34).
Chicago—such places as Adler Planetarium and Astronomical Museum, Hull House, Museum of Science and Industry, Shedd Aquarium, Union Stockyards, Chicago Portage Natl. Historic Site (*see* Chicago) (11).
Chicago Zoological Park (Brookfield Zoo)—animals in natural settings (10).
Eads Bridge—spans Mississippi River at East St. Louis; first truss bridge using steel; built in 1874 (28).
Elijah P. Lovejoy Monument—honoring antislavery editor killed by a mob at Alton (25).
Grand Detour—picturesque village preserving 19th-century atmosphere (8).
Galena—lead-mining center of 1840's; many old mansions including Grant Memorial House (1).
Lilacia Park—Lombard: more than 300 kinds of lilacs; tulips and pansies (9).
Mound City Marine Ways—Civil War shipbuilding yards; now services river craft (34).
Old Slave House—near Shawneetown; believed to have been prison for captured runaway slaves (31).
Piasa Bird—restored Indian painting of legendary monster on Alton bluff; 30 ft. long, 17 ft. high (25).
Pierre Menard House—home of first lieutenant governor of the state; completed in 1802; near Chester (29).
Sarah Lincoln House—home of Lincoln's stepmother (22).
Springfield—Abraham Lincoln Home; Lincoln Tomb, final resting place of The Great Emancipator (20).
Vandalia State House—fourth capitol of Illinois; white brick building preserved as a museum (26).

*Numbers in parentheses are keyed to map.



LARGEST CITIES (1950 census)

Chicago (3,620,962): second largest city in U.S.; meat-packing center of the world; railroad hub of U.S.; Great Lakes port; cultural and educational center of Midwest; large and diversified industry; grain market.
Peoria (111,856): wholesale and retail trade center; river-rail terminal; manufactures tractors, machinery, liquor.
Rockford (92,927): tools, hardware, textiles, furniture.
East St. Louis (82,295): industrial and railroad center.
Springfield (81,628): state capital; in rich farm area.
Evanston (73,641): residential suburb north of Chicago.
Cicero (67,544): industrial town west of Chicago.
Decatur (66,269): soybean, corn products; railway shops.

Illinois Fact Summary

THE PEOPLE BUILD THEIR STATE

1673—Explorers Father Jacques Marquette and Louis Joliet go down Mississippi, now western boundary of Illinois; meet Kaskaskia Indians near Starved Rock; return by way of Illinois and Des Plaines rivers; reach Lake Michigan over Chicago portage.

1675—Marquette establishes Mission of the Immaculate Conception near Starved Rock, first mission in Mississippi Valley; Marquette becomes ill, starts back to Canada but dies en route.

1679—René Robert Cavelier, Sieur de La Salle crosses Illinois region to Lake Peoria; builds Fort Crèvecoeur on lake, January 1680; fort is abandoned in his absence. Father Louis Hennepin discovers first coal in North America on Illinois River.

1682—La Salle builds Fort St. Louis at Starved Rock; claims Mississippi Valley for France.

1690—Henri de Tonti, La Salle's lieutenant, granted colonization rights in Illinois area; moves Fort St. Louis to Lake Peoria, 1691–92.

1699—French Mission of the Holy Family founded at Cahokia; becomes French center in Illinois country.

1703—Mission moved from Starved Rock to Kaskaskia.

1720—French build Fort Chartres north of Kaskaskia; Illinois area becomes district of French Louisiana.

1763—Illinois included in area ceded by France to Great Britain in Treaty of Paris.

1769—Kaskaskia Indian kills Chief Pontiac at Cahokia; tribesmen of Pontiac in revenge almost wipe out Illinois Confederacy.

1778—George Rogers Clark captures Kaskaskia and Cahokia from British; repulses British attacks, 1780. Virginia claims Illinois as a county.

1783—Illinois part of territory ceded to U. S. by British.

1787—Congress organizes Northwest Territory; includes Illinois country.

1800—Congress creates Indiana Territory; includes Illinois; act effective July 4, 1801.

1803—Fort Dearborn constructed on site of Chicago.

1804—Sauk and Fox Indians cede to U. S. title to their lands east of Mississippi River.

1809—Congress creates Illinois Territory, February 3; includes present Wisconsin; capital, Kaskaskia.

1811—First steamboat on Ohio and Mississippi rivers docks at Shawneetown.

1812—Potawatomi Indians massacre troops at Fort Dearborn, August 15; fort rebuilt, 1816.

1818—Illinois becomes 21st state, December 3; capital, Kaskaskia; governor, Shadrach Bond. Illinois northern border fixed at 42°30′ N.

1820—State capital moved to Vandalia.

1824—Proposed constitutional amendment to legalize slavery in state defeated by popular vote.

1825—Opening of Erie Canal brings many new settlers.

1826—Rush to Galena lead mines begins.

1832—Black Hawk War drives Sauk and Fox Indians from northern Illinois. Winnebago Indians cede holdings southeast of Wisconsin and Fox rivers.

1833—Chicago incorporated as a village; incorporated as a city, 1837. Remaining Illinois Indians sell their holdings and move west of Mississippi River.

1836—Illinois and Michigan Canal begun; opens, 1848.

1837—Springfield chosen state capital; legislature meets there, 1839. Elijah P. Lovejoy, editor of abolitionist *Alton Observer*, killed by proslavery mob.

1839—Mormons come to Nauvoo. Mormon War begins in Hancock County, 1844; Mormon leaders, Joseph and Hyrum Smith, killed; war ends, 1846.

1845—Free education act passed.

1847—Cyrus McCormick opens reaper factory in Chicago.

1848—Galena and Chicago Union R.R. brings first freight into Chicago; rail service extended, 1852.

1850—Congress grants Illinois more than 2,500,000 acres of land to aid railroad construction.

1851—Northwestern University chartered; opens in Evanston, 1855.

1856—Illinois Central Railroad opens; rail link between Chicago and the east completed, 1857.

1858—Abraham Lincoln and Stephen A. Douglas, campaigning for Senate, hold famous debates on slavery issue; Douglas wins election. George M. Pullman manufactures sleeping cars at Chicago.

1860—Abraham Lincoln, Springfield lawyer, nominated for presidency at Chicago; elected 16th (and 1st Republican) president of U. S.

1865—Chicago Union Stockyards incorporated.

1867—University of Illinois founded at Urbana.

1869—Union Pacific R. R. links Chicago with west coast.

1870—Present state constitution adopted.

1871—Great Chicago fire burns most of city, Oct. 8–9.

1872—Montgomery Ward & Company, pioneer mail-order house, organized in Chicago; Sears, Roebuck & Company formed in Chicago, 1893.

1881—Aurora is 1st U. S. city with electric street lights.

1886—Strike of McCormick harvester workers for 8-hour day leads to Haymarket riot in Chicago, May 4.

1889—Jane Addams founds Hull House in Chicago.

1891—Child labor act passed; Australian ballot adopted.

1892—University of Chicago opens.

1893—World's Columbian Exposition held at Chicago.

1894—Strike of Pullman Car Co. workers at Chicago spreads to nation; federal troops sent to Chicago.

1900—Chicago Drainage Canal opened; becomes part of Illinois Waterway, 1933.

1903—Chicago's Iroquois Theater fire kills 596, Dec. 30.

1911—Workmen's compensation act passed.

1915—Steamer *Eastland* capsizes in Chicago River, July 24; 812 persons die.

1922—Voters reject proposed new state constitution. At Herrin 22 are killed in coal strikes, June 21–22.

1933—Century of Progress exposition opens at Chicago; reopens, 1934. Retailers' occupation (sales) tax of 2% adopted; changed to 3%, 1935, and 2%, 1941.

1937—Oil strikes in Marion County boom petroleum industry in state.

1942—First atomic pile in history activated at secret project at University of Chicago, December 2.

1943—Chicago subway opened; extended, 1951.

1946—Atomic Energy Commission opens Argonne National Laboratory at University of Chicago.

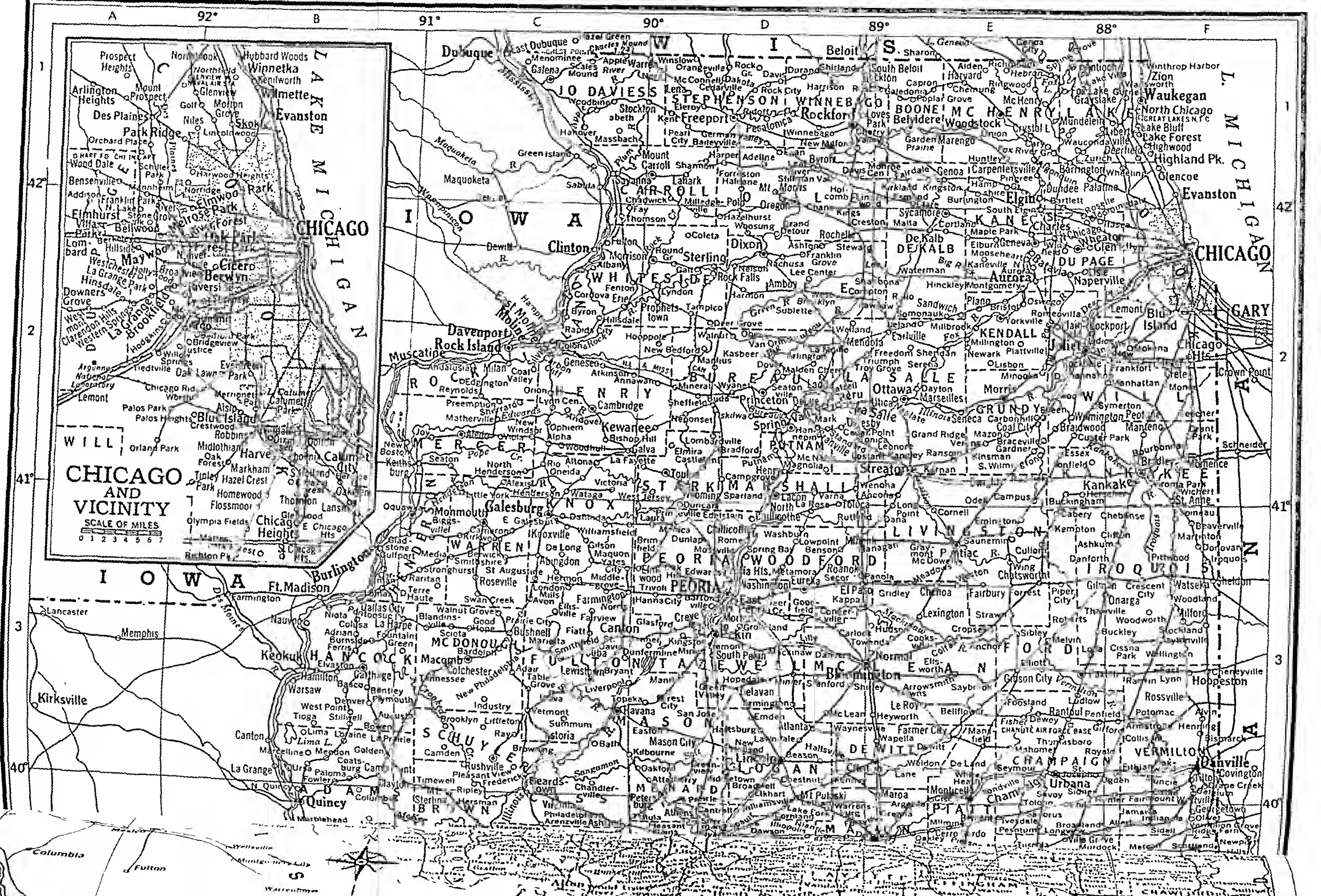
1947—Coal mine explosion at Centralia kills 111 miners; 119 killed at West Frankfort coal mine, 1951.

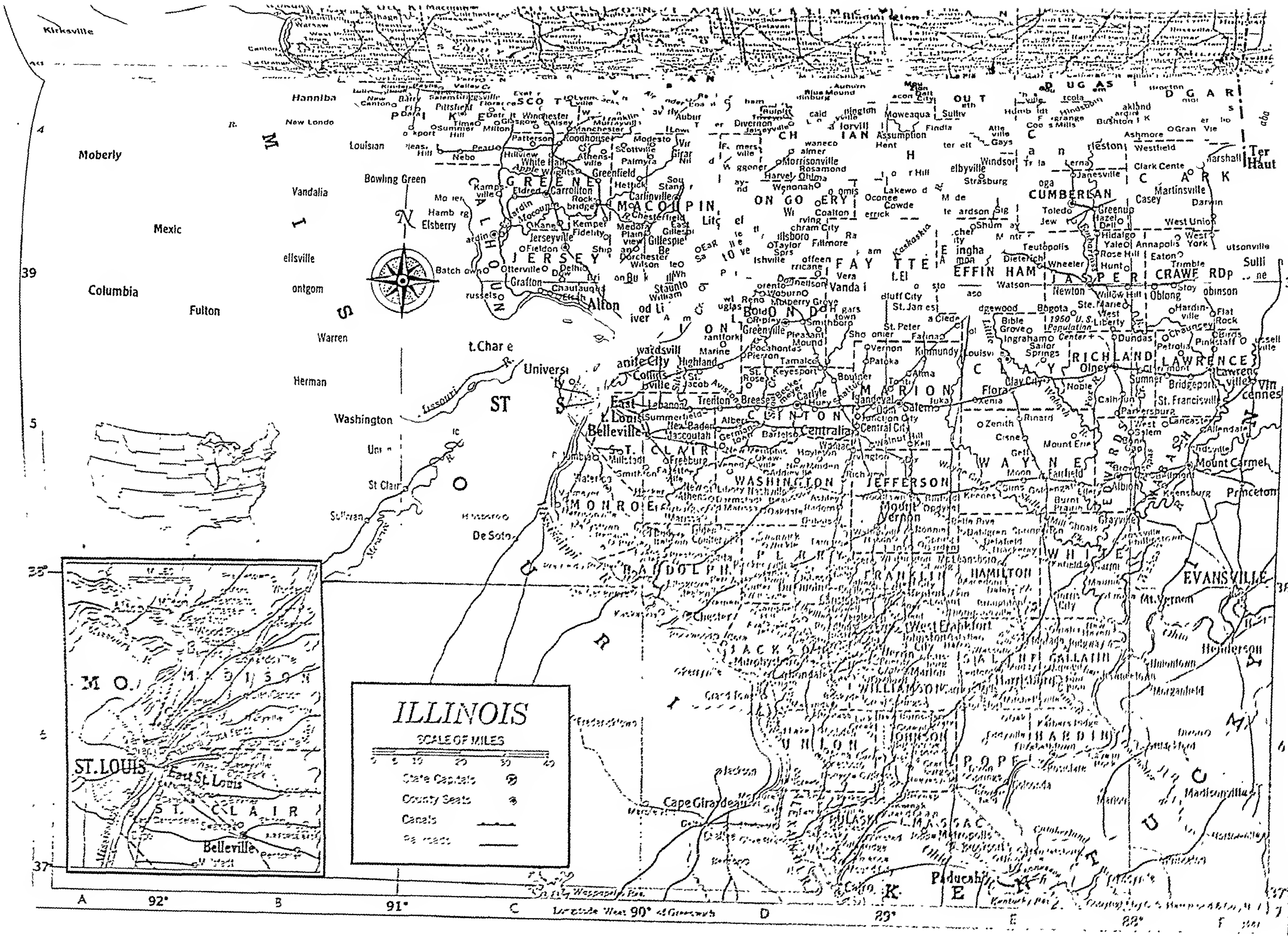
1950—Gateway Amendment is adopted to simplify amending state constitution. Census shows shift of center of population of U. S. to near Olney.

1952—Democratic and Republican party conventions held in Chicago. Adlai E. Stevenson, governor of Illinois, is unsuccessful candidate for president.

1953—Illinois Toll Road Commission established to construct toll roads in the state.

1954—Congress approves United States participation with Canada in St. Lawrence Seaway Project; Chicago may become an ocean port.


CHICAGO AND VICINITY
SCALE OF MILES
0 1 2 3 4 5 6 7
LAKE MICHIGAN
L. MICHIGAN
WIS.
IOWA
IND.
A
B
C
D
E
F
1
2
3
92°
91°
90°
89°
88°
42°
41°
40°
CHICAGO
GARY
Evanston
Waukegan
Highland Pk.
Dubuque
Galena
Freeport
Rockford
Beloit
Belvidere
Woodstock
Elgin
Aurora
Joliet
Kankakee
Clinton
Davenport
Rock Island
Moline
Muscatine
Sterling
Dixon
Galesburg
Kewanee
Peoria
Ottawa
La Salle
Streator
Bloomington
Normal
Burlington
Ft. Madison
Keokuk
Quincy
Macomb
Canton
Monmouth
Danville
Urbana
Champaign
Kirksville
JO DAVIESS
STEPHENSON
WINNEBAGO
BOONE
MC HENRY
LAKE
CARROLL
OGLE
DE KALB
KANE
DU PAGE
COOK
WHITESIDE
LEE
KENDALL
WILL
ROCK ISLAND
HENRY
BUREAU
LA SALLE
GRUNDY
KANKAKEE
MERCER
PUTNAM
STARK
MARSHALL
LIVINGSTON
IROQUOIS
WARREN
KNOX
PEORIA
WOODFORD
HENDERSON
HANCOCK
MC DONOUGH
FULTON
TAZEWELL
MC LEAN
FORD
VERMILION
CHAMPAIGN
DE WITT
MASON
LOGAN
SCHUYLER
BROWN
ADAMS
MENARD
PIATT
MACON
Mississippi R.
Illinois R.
Des Moines R.
Maquoketa R.


ILLINOIS
SCALE OF MILES
State Capitals
County Seats
Canals
ST. LOUIS
East St. Louis
Belleville
ST. CLAIR
Alton
Cape Girardeau
Paducah
EVANSVILLE
Mt. Vernon
Henderson
Madisonville
Princeton
Mount Carmel
Vincennes
Terre Haute
Kirksville
Moberly
Mexico
Columbia
Fulton
Hannibal
Louisiana
Bowling Green
Vandalia
Warren
Herman
Washington
De Soto
GREENE
JERSEY
MACOUPIN
FAYETTE
EFFINGHAM
JASPER
CRAWFORD
RICHLAND
LAWRENCE
CUMBERLAND
CLARK
MARION
CLINTON
WASHINGTON
JEFFERSON
WAYNE
HAMILTON
FRANKLIN
WILLIAMSON
UNION
JOHNSON
POPE
HARDIN
GALLATIN
MASSAC
PULASKI
MONROE
RANDOLPH
Centralia
Salem
Olney
Flora
Greenville
Carlinville
Jerseyville
Carrollton
Grafton
West Frankfort
Newton
Marshall
Casey
Toledo
Longitude West 90° of Greenwich
A
92°
B
91°
C
D
89°
E
88°
F
39
38
37

Elmwood Park	18,801	B 2
Elsah	520	C 5
Elvaston	238	B 3
Elwood	420	E 2
Emden	406	D 3
Emington	150	E 3
Emma		E 6
Energy	503	E 6
Enfield	906	E 5
Equality	830	E 6
Erie	1,180	C 2
Esmond	75	E 1
Essex	284	E 2
Eureka	2,367	D 3
Evanston	73,641	B 1
Evansville	821	D 5
Evergreen Park	10,531	B 2
Ewing	330	E 5
Exeter	107	C 4
Ezra	100	E 6
Fairbury	2,433	E 3
Fairdale	150	E 1
Fairfield	5,576	E 5
Fairgrange		E 4
Fairmont City	2,284	B 6
Fairmount	618	F 3
Fairview	568	C 3
Fancy Prairie	110	D 4
Farina	787	E 5
Farmer City	1,752	E 3
Farmersville	485	D 4
Farmington	2,651	C 3
Fay	124	C 2
Fayetteville	245	D 5
Fenton		C 2
Ferris	226	B 3
Fiatt	200	C 3
Fidelity	157	C 4
Fieldon	250	C 4
Fillmore	384	D 4
Findlay	680	E 4
Fisher	894	E 3
Fithian	414	F 3
Flanagan	672	E 3
Flat Rock	558	F 5
Flora	5,255	E 5
Florence	107	C 4
Flossmoor	1,804	B 3
Foosland	200	E 3
Forest City	278	D 3
Forest Park	14,969	B 2
Forest View	291	*B 2
Forrest	1,040	E 3
Forreston	1,048	D 1
Forsyth	370	D 4
Fountain Green	145	C 3
Fowler	175	B 3
Fox Lake	2,238	E 1
Fox River Gr.	1,313	E 1
Frankfort	685	F 2
Franklin	438	C 4
Franklin Grove	741	D 2
Franklin Pk.	8,899	A 2
Frederick	175	C 3
Freeburg	1,661	D 5
Freedom	110	E 2
Freeman Spur	451	*D 6
Freeport	22,467	D 1
Friendsville	100	F 5
Fulton	2,706	C 2
Fults	120	*C 5
Galatia	933	E 6
Gale	150	D 6
Galena	4,648	C 1
Galesburg	31,425	C 3
Galt		D 2
Galva	2,886	D 2
Garden Prairie	300	E 1
Gardner	981	E 2
Garrett	213	E 4
Gays	261	E 4
Geff	326	E 5
Geneseo	4,325	C 2
Geneva	5,139	E 2
Genoa	1,690	E 1
Georgetown	3,294	F 4
German Valley	206	D 1
Germantown	811	D 5
Gibson City	3,029	E 3
Gifford	350	E 3
Gilberts	183	*E 1
Gillespie	4,105	D 4
Gilman	1,602	E 3
Gilson	250	C 3
Girard	1,740	D 4
Gladstone	340	B 3
Glasford	922	D 3
Glasgow	158	C 4
Glen Carbon	1,176	B 6
Glen Ellyn	9,524	F 2
Glencoe	6,980	F 1
Glenview	6,142	B 1
Glenwood	762	B 3
Godley	102	*E 2
Golconda	1,066	E 6
Golden	512	B 3
Goldengate	199	E 5
Golf	258	A 1
Good Hope	392	C 3
Goodfield	281	D 3
Goreville	581	E 6
Gorham	447	D 6
Grafton	1,117	C 5
Grand Chain	330	E 6
Grand Detour	400	D 2
Grand Ridge	530	E 2
Grand Tower	963	D 6
Grand View	75	F 4
Grandview	1,349	D 4
Granite City	29,465	B 6
Grant Park	564	F 2
Grantfork	162	D 5
Grantsburg	100	E 6
Granville	978	D 2
Grape Creek	200	F 3
Graymont	132	E 3
Grayslake	1,970	E 1
Grayville	2,461	E 5
Green Valley	503	D 3
Greenfield	987	C 4
Greenup	1,360	E 4
Greenview	795	D 3
Greenville	4,069	D 5
Gridley	817	E 3
Griggsville	1,199	C 4
Groveland	200	D 3
Gulfport	232	B 3
Gurnee	1,097	F 1
Hagarstown	84	D 5
Hainesville	154	*E 1
Haldane		D 1
Hallsville	123	D 3
Hamburg	225	C 4
Hamel	250	B 6
Hamilton	1,776	B 3
Hamletsburg	131	E 6
Hammond	405	E 4
Hampshire	970	E 1
Hampton	706	C 2
Hanaford (Logan)	280	E 5
Hanna City	671	D 3
Hanover	1,643	C 1
Harco	300	E 6
Hardin	928	C 4
Hardinville	150	F 5
Harmon	208	D 2
Harper	45	D 1
Harrisburg	10,999	E 6
Harrison	116	D 1
Harrisonville	100	C 5
Harristown	200	D 4
Hartford	1,909	B 6
Hartsburg	245	D 3
Harvard	3,464	E 1
Harvel	301	D 4
Harvey	20,683	B 2
Harwood Hts.	655	B 1
Havana	4,379	D 3
Hazel Crest	2,129	B 2
Hazel Dell	150	E 4
Hazelhurst	29	D 2
Hebron	696	E 1
Hecker	204	D 5
Henderson	166	C 2
Hennepin	312	D 2
Henning	283	F 3
Henry	1,966	D 2
Henton	65	E 4
Hermon	67	C 3
Herrick	554	D 4
Herrin	9,331	E 6
Herscher	515	E 2
Hersman	138	C 4
Hettick	268	C 4
Heyworth	1,072	E 3
Hidalgo	107	E 4
Highland	4,283	D 5
Highland Park	16,808	F 1
Highwood	3,813	F 1
Hillsboro	4,141	D 4
Hillsdale	425	C 2
Hillside	2,131	A 2
Hillview	419	C 4
Hinckley	774	E 2
Hindsboro	377	E 4
Hinsdale	8,676	A 2
Hodgkins	536	A 2
Holcomb	200	D 1
Hollowayville	89	*D 2
Hollywood	1,776	A 2
Homer	1,030	F 3
Homewood	5,887	B 3
Hoopeston	5,992	F 3
Hooppole	195	D 2
Hopedale	574	D 3
Hoyleton	462	D 5
Hubbard Woods		B 1
Hudson	339	E 3
Huey	175	D 5
Hull	489	B 4
Humboldt	295	E 4
Hume	448	F 4
Humphrey (Tovey)	593	D 4
Hunt	104	E 4
Huntley	830	E 1
Hurricane	32	D 4
Hurst	858	D 6
Hutsonville	647	F 4
Illiopolis	833	D 4
Ina	432	E 5
Indianola	392	F 4
Industry	496	C 3
Ingalls Park	6,840	F 2
Ingraham	202	E 5
Iola	213	E 5
Ipava	667	C 3
Iroquois	232	F 3
Irving	539	D 4
Irvington	379	D 5
Irwin	85	*E 2
Itasca	1,274	F 2
Iuka	450	E 5
Ivesdale	407	E 4
Jacksonville	20,387	C 4
Jamaica		F 4
Jamestown	70	D 5
Janesville	165	E 4
Jeffersonville (Geff)	326	E 5
Jeiseyville	199	D 4
Jerome	689	D 4
Jerseyville	5,792	C 4
Jewett	253	E 4
Johnsonville	105	*E 5
Johnston City	4,479	E 6
Joliet	51,601	E 2
Jonesboro	1,607	D 6
Joppa	513	E 6
Joy	505	C 2
Junction	239	E 6
Junction City	353	D 5
Justice	854	B 2
Kampsville	437	C 4
Kane	485	C 4
Kaneville	250	E 2
Kangley	296	E 2
Kankakee	25,856	F 2
Kansas	835	F 4
Kappa	125	D 3
Karbers Ridge		E 6
Karnak	792	E 6
Kasbeer	125	D 2
Kaskaskia	112	C 6
Keenes		E 5
Keensburg	302	F 5
Keithsburg	1,006	B 2
Kell	193	E 5
Kemp	60	E 4
Kemper	42	C 4
Kempton	255	E 3
Kenilworth	2,789	B 1
Kenney	409	D 3
Kent	103	D 1
Kernan	56	E 2
Kewanee	16,821	C 2
Keyesport	438	D 5
Kilbourne	374	D 3
Kincaid	1,793	D 4
Kinderhook	299	B 4
Kings	250	D 2
Kingston	327	E 1
Kingston Mines	404	D 3
Kinmundy	912	E 5
Kinsman	147	E 2
Kirkland	685	E 1
Kirkwood	747	C 3
Knoxville	2,209	C 3
La Clede		E 5
La Fayette	301	D 2
La Grange	12,002	A 2
La Grange Park	6,176	A 2
La Harpe	1,295	C 3
La Moille	505	D 2
La Place		E 4
La Prairie	142	B 3
La Rose	178	D 3
La Salle	12,083	D 2
Lacon	2,020	D 2
Ladd	1,224	D 2
Lake Bluff	2,000	F 1
Lake City	160	E 4
Lake Forest	7,819	F 1
Lake Fork	127	D 4
Lake Villa	824	E 1
Lake Zurich	850	E 1
Lakewood	393	*E 1
Lakewood	200	E 4
Lanark	1,359	D 1
Lancaster	134	F 5
Lane		E 3
Langleyville	300	D 4
Lansing	8,682	B 3
Latham	387	D 4
Laura	150	D 3
Lawndale	150	D 3
Lawrenceville	6,328	F 5
Le Roy	1,820	E 3
Leaf River	444	D 1
Lebanon	2,417	D 5
Ledford	120	E 6
Lee	251	E 2
Lee Center	320	D 2
Leland	537	E 2
Lemont	2,757	A 2
Lena	1,227	D 1
Lenzburg	431	D 5
Leonore	204	E 2
Lerna	304	E 4
Lewistown	2,630	C 3
Lexington	1,181	E 3
Liberty	300	B 4
Liberty (Burnt Prairie)	172	E 5
Libertyville	5,425	F 1
Lick Creek		D 6
Lidice	3,000	E 2
Lilly	78	D 3
Lima	154	B 3
Lincoln	14,362	D 3
Lincolnwood	3,072	B 1
Lindenwood	150	D 1
Lisbon	183	E 2
Lisle	4,500	E 2
Litchfield	7,208	D 4
Little York	324	C 2
Littleton	215	C 3
Liverpool		C 3
Livingston	999	D 5
Loami	439	D 4
Lockport	4,955	F 2
Loda	559	E 3
Logan	280	E 6
Lomax	490	B 3
Lombard	9,817	A 2
Lombardville	101	D 2
London Mills	581	C 3
Long Point	286	E 3
Longview	239	E 4
Loraine	370	B 3
Lostant	432	D 2
Louisville	970	E 5
Lovejoy	2,568	A 6
Loves Park	5,366	E 1
Lovington	1,152	E 4
Lowder		D 4
Lowpoint	250	D 3
Ludlow	475	E 3
Lyndon	594	D 2
Lynn Center	75	C 2
Lynnville	101	C 4
Lyons	6,120	B 2
Macedonia	127	E 5
Mackinaw	1,011	D 3
Macomb	10,592	C 3
Macon	942	E 4
Madison	7,963	B 6
Maeystown	137	C 5
Magnolia	285	D 2
Mahomet	1,017	E 3
Makanda	214	D 6
Malden	217	D 2
Malta	510	E 2
Manchester	351	C 4
Manhattan	728	F 2
Manito	869	D 3
Manlius	368	D 2
Mannheim		A 2
Mansfield	665	E 3
Manteno	1,789	F 2
Maple Park	433	E 2
Mapleton	300	D 3
Maquon	361	C 3
Marblehead	193	B 4
Marceline	60	B 3
Marengo	2,726	E 1
Marietta	178	C 3
Marine	657	D 5
Marion	10,459	E 6
Marissa	1,652	D 5
Mark	449	D 2
Markham	2,753	B 2
Maroa	1,100	E 3
Marseilles	4,514	E 2
Marshall	2,960	F 4
Martinsville	1,440	F 4
Martinton	292	F 3
Maryville	539	B 6
Mascoutah	3,009	D 5
Mason	327	E 5
Mason City	2,004	D 3
Massbach	37	C 1
Matherville	590	C 2
Matteson	1,211	B 3
Mattoon	17,547	E 4
Maunie	412	E 5
Maywood	27,473	A 2
Mazon	586	E 2
McClure	350	D 6
McConnell	200	D 1
McCook	361	A 2
McDowell	50	E 3
McHenry	2,080	E 1
McLean	667	D 3
McLeansboro	3,008	E 5
McNabb	190	D 2
Meadows	150	E 3
Mechanicsburg	464	D 4
Media	148	C 3
Medora	432	C 4
Melrose Pk.	13,366	A 2
Melvin	535	E 3
Mendon	625	B 3
Mendota	5,129	D 2
Menominee	132	C 1
Meredosia	940	C 4
Merrionette Park	1,101	B 2
Merritt	80	C 4
Metamora	1,368	D 3
Metcalf	312	F 4
Metropolis	6,093	E 6
Middlegrove	200	C 3
Middletown	480	D 3
Midlothian	3,216	B 2
Milan	1,737	C 2
Milford	1,648	F 3
Mill Shoals	417	E 5
Millbrook	100	E 2
Millcreek	127	D 6
Milledgeville	1,044	D 1
Millington	270	E 2
Millstadt	1,566	B 6
Milmine	95	E 4
Milton	337	C 4
Milton	8,232	B 6
Mineral	274	D 2
Minier	780	D 3
Minonk	1,955	D 3
Minooka	369	E 2
Mitchellsville	20	E 6
Mode	133	E 4
Modesto	232	D 4
Modoc	108	C 5
Mokena	903	F 2
Moline	37,397	C 2
Momence	2,644	F 2
Monee	554	F 2
Monica	185	D 3
Monmouth	10,193	C 3
Monroe Center	215	E 1
Monsanto	357	B 6
Montgomery	773	E 2
Monticello	2,612	E 3
Montrose	309	E 4
Moon	50	E 5
Mooseheart		E 2
Moro	275	B 6
Morris	6,926	E 2
Morrison	3,531	C 2
Morrisonville	1,182	D 4
Morton	3,693	D 3
Morton Gr.	3,926	B 1
Mossville	350	D 3
Mound City	2,167	D 6
Mound Station (Timewell)	184	C 3
Mounds	2,001	D 6
Mount Auburn	414	D 4
Mt. Carmel	8,732	F 5
Mt. Carroll	1,950	D 1
Mount Clare	260	*D 4
Mount Erie	149	E 5
Mt. Morris	2,709	D 1
Mt. Olive	2,401	D 4
Mt. Prospect	4,009	A 1
Mt. Pulaski	1,526	D 3
Mt. Sterling	2,246	C 4
Mt. Vernon	15,600	E 5
Mount Zion	438	E 4
Moweaqua	1,475	E 4
Mozier	125	C 4
Muddy	500	E 6
Mulberry Grove	712	D 5
Muncie	197	F 3
Mundelein	3,189	E 1
Murdock	300	E 4
Murphysboro	9,241	D 6
Murrayville	405	C 4
Nachusa	150	D 2
Nameoki		B 6
Naperville	7,013	E 2
Naplate	783	E 2
Naples	141	C 4
Nashville	2,432	D 5
Nason	199	D 5
National Stock Yards (Nat'l City)	207	B 6
Nauvoo	1,242	B 3
Nebo	413	C 4
Nelson	289	D 2
Neoga	1,125	E 4
Neponset	501	D 2
New Athens	1,518	D 5
New Baden	1,428	D 5
New Bedford	225	D 2
New Berlin	622	D 4
New Boston	767	B 2
New Burnsido	244	E [illegible]
New Canton	449	B [illegible]
New Douglas	359	D [illegible]
New Grand Chain (Grand Chain)	330	D [illegible]
New Haven	819	E [illegible]
New Holland	343	[illegible]
New Lenox	1,235	[illegible]
New Memphis	350	[illegible]
New Milford	340	[illegible]
New Minden	160	D 5
Now Philadelphia		C 3
Now Salem	184	C 4

*No room on map for name.

New Windsor	569	C 2
Newark	457	E 2
Newman	1,140	F 4
Newton	2,780	E 5
Niantic	625	D 4
Niles	3,587	A 1
Nilwood	321	D 4
Niota	250	B 3
Noble	776	E 5
Nokomis	2,544	D 4
Nora	208	D 1
Normal	9,772	E 3
Norridge	3,428	B 1
Norris	319	C 3
Norris City	1,370	E 6
N. Aurora	921	E 2
N. Chicago	8,628	F 1
N. Chillicothe	1,741	D 3
N. City (Coello)	513	E 5
N. Henderson		C 2
N. Lake	4,361	A 2
N. Pekin	1,758	*D 3
N. Quincy	2,985	B 4
N. Riverside	3,230	B 2
N. Utica (Utica)	985	E 2
Northbrook	3,348	A 1
Northfield	1,426	B 1
Oak		E 6
Oak Forest	1,856	B 2
Oak Hill	150	D 3
Oak Park	63,529	B 2
Oakdale	570	D 5
Oakford	281	D 3
Oakglen		B 3
Oakland	980	F 4
Oaklawn	8,751	B 2
Oakley	150	E 4
Oakwood	641	F 3
Oblong	1,639	F 5
Oconee	256	D 4
Odell	908	E 2
Odin	1,341	D 5
O'Fallon	3,022	B 6
Ogden	436	F 3
Oglesby	3,922	D 2
Ohio	561	D 2
Ohlman		D 4
Okawville	855	D 5
Old Marissa	200	D 5
Old Ripley	135	D 5
Olive Branch		D 6
Olivet	325	F 4
Olmsted	525	D 6
Olney	8,612	E 5
Olympia Fields	160	B 3
Omaha	394	E 6
Onarga	1,455	F 3
Oneida	554	C 2
Opdyke	200	E 5
Ophiem	150	C 2
Oquawka	929	C 3
Orangeville	460	D 1
Oraville	200	D 6
Orchard Place	500	A 1
Oreana	148	E 4
Oregon	3,205	D 1
Orient	801	E 6
Orion	829	C 2
Orland Park	788	A 2
Oswego	1,220	E 2
Ottawa	16,957	E 2
Otterville	118	C 4
Owaneco	343	D 4
Ozark		E 6
Palatine	4,079	E 1
Palestine	1,589	F 4
Palmer	335	D 4
Palmyra	746	C 4
Paloma	150	B 3
Palos Hts.	1,600	A 2
Palos Park	854	A 2
Pana	6,178	D 4
Panama	520	D 4
Panola	52	E 3
Papineau	157	F 3
Paris	9,460	F 4
Park Forest	8,138	B 3
Park Ridge	16,602	A 1
Parkersburg	288	F 5
Patoka	602	D 5
Patterson	147	C 4
Pawnee	974	D 4
Pawpaw	594	E 2
Paxton	3,795	E 3
Payson	490	B 4
Pearl	472	C 4
Pearl City	491	D 1
Pecatonica	1,438	D 1
Pekin	21,858	D 3
Penfield	300	F 3
Peoria	111,856	D 3
Peoria Hts.	5,425	D 3
Peotone	1,395	F 2
Percy	933	D 5
Perks	295	D 6
Perry	444	C 4
Peru	8,653	D 2
Pesotum	415	E 4
Petersburg	2,325	D 4
Petrolia	200	F 5
Philadelphia	110	C 4
Phillipstown	102	F 5
Philo	525	E 3
Phoenix	3,606	B 2
Pierron	371	D 5
Pierson Sta.	130	E 4
Pinckneyville	3,299	D 5
Pingree Grove	162	E 1
Pinkstaff	235	F 5
Piper City	735	E 3
Pittsburg	612	E 6
Pittsfield	3,564	C 4
Pittwood		F 3
Plainfield	1,764	E 2
Plainview	210	C 4
Plainville	242	B 4
Plano	2,154	E 2
Plattville		E 2
Pleasant Hill	856	C 4
Pleasant Md.	110	D 5
Pleasant Plains	500	D 4
Pleasant View	150	C 3
Plymouth	854	C 3
Pocahontas	667	D 5
Polo	2,242	D 1
Pontiac	8,990	E 3
Pontoosuc	214	B 3
Poplar Grove	417	E 1
Port Byron	1,050	C 2
Posen	1,795	B 2
Potomac	602	F 3
Prairie City	500	C 3
Prairie du Rocher	662	C 5
Prairietown	150	B 5
Preemption	150	C 2
Prentice	60	C 4
Preston	103	D 5
Princeton	5,765	D 2
Princeville	1,113	D 3
Prophetstown	1,691	D 2
Prospect Hts.	1,800	A 1
Pulaski	478	D 6
Putnam	90	D 2
Quincy	41,450	B 4
Radom	134	D 5
Raleigh	262	E 6
Ramsey	808	D 4
Rankin	737	F 3
Ransom	411	E 2
Rantoul	6,387	E 3
Rapids City	487	C 2
Rardin	230	E 4
Raritan	228	C 3
Ray	85	C 3
Raymond	779	D 4
Red Bud	1,519	D 5
Reddick	208	E 2
Redmon	226	F 4
Reevesville	110	E 6
Renault		C 5
Reno	224	D 5
Rentchler	50	B 6
Reynolds	409	C 2
Richmond	623	E 1
Richton Park	232	B 3
Richview	352	D 5
Ridge Farm	905	F 4
Ridgway	1,148	E 6
Ridott	187	D 1
Rinard	100	E 5
Ringwood	175	E 1
Rio	200	C 2
Ripley	177	C 3
River Forest	10,823	B 2
River Grove	4,839	A 2
Riverdale	5,840	B 2
Riverside	9,153	B 2
Riverton	1,450	D 4
Roanoke	1,368	D 3
Robbins	4,766	B 2
Roberts	416	E 3
Robinson	6,407	F 5
Rochelle	5,449	D 2
Rochester	506	D 4
Rock City	157	D 1
Rock Falls	7,983	D 2
Rock Grove	150	D 1
Rock Island	48,710	C 2
Rockbridge	243	C 4
Rockdale	1,393	E 2
Rockford	92,927	D 1
Rockport	232	B 4
Rockton	1,432	E 1
Rockwood	175	D 6
Rollo	24	E 2
Rome	600	D 3
Rome (Dix)	190	E 5
Romeoville	147	E 2
Roodhouse	2,368	C 4
Rosamond	300	D 4
Roscoe	700	D 1
Rose Hill	128	E 4
Roselle	1,038	E 1
Roseville	1,080	C 3
Rosiclare	2,086	E 6
Rossville	1,382	F 3
Round Grove		D 2
Round Lake	573	*E 1
Round Lake Beach	1,892	*E 1
Round L. Pk.	1,836	*E 1
Roxana	1,911	B 6
Royal	156	E 3
Royalton	1,506	D 6
Ruma	107	C 5
Rushville	2,682	C 3
Russellville	207	F 5
Rutland	486	D 3
Sadorus	388	E 4
Sailor Springs	259	E 5
Saint Anne	1,403	F 2
St. Augustine	198	C 3
St. Charles	6,709	E 2
Saint David	812	C 3
Saint Elmo	1,716	E 4
St. Francisville	1,117	F 5
Saint Jacob	478	D 5
Saint James	60	E 5
Saint Johns	275	D 5
Saint Joseph	941	E 3
Saint Libory	324	D 5
Saint Peter	354	E 5
Saint Rose	125	D 5
Sainte Marie	352	E 5
Salem	6,159	E 5
San Jose	562	D 3
Sandoval	1,531	D 5
Sandusky	350	D 6
Sandwich	3,027	E 2
Saunemin	338	E 3
Savanna	5,058	C 1
Savoy	145	E 3
Sawyerville	390	D 4
Saybrook	758	E 3
Scales Mound	385	C 1
Schiller Park	1,384	A 1
Schram City	793	D 4
Sciota	128	C 3
Scottland	100	F 4
Scottville	200	C 4
Seaton	285	C 2
Seatonville	405	D 2
Secor	375	D 3
Seneca	1,435	E 2
Serena	165	E 2
Sesser	2,086	D 5
Seymour	275	E 3
Shabbona	667	E 2
Shannon	668	D 1
Shattuc	200	D 5
Shawneetown	1,917	E 6
Sheffield	995	D 2
Shelbyville	4,462	E 4
Sheldon	1,114	F 3
Sheridan	476	E 2
Sherman		D 4
Sherrard	484	C 2
Shiloh	453	B 6
Shipman	376	C 4
Shirland		D 1
Shirley	140	E 3
Shobonier	315	D 5
Shumway	248	E 4
Sibley	345	E 3
Sidell	554	F 4
Sidney	653	E 3
Sigel	296	E 4
Silvis	3,055	C 2
Simpson	119	E 6
Sims	408	E 5
Skokie	14,832	B 1
Smithboro	253	D 5
Smithfield	355	C 3
Smithshire	150	C 3
Smithton	515	C 5
Somonauk	721	E 2
Sorento	692	D 5
S. Beloit	3,221	E 1
S. Chicago Heights	2,129	B 3
S. Elgin	1,220	E 2
S. Holland	3,247	B 2
S. Jacksonville	1,165	C 4
S. Pekin	1,043	D 3
S. Standard	192	D 4
S. Wilmington	662	E 2
Southern View	898	*D 4
Sparland	509	D 2
Sparta	3,576	D 5
Spaulding	211	D 4
Spillertown	196	*E 6
Spring Bay	203	D 3
Spring Garden		E 5
Spring Grove	269	E 1
Spr. Valley	4,916	D 2
Springerton	279	E 5
SPRINGFIELD	81,628	D 4
Standard	290	D 2
Standard City (S. Standard)	192	D 4
Stanford	457	D 3
Staunton	4,047	D 5
Steeleville	1,353	D 6
Steger	4,358	F 2
Sterling	12,817	D 2
Steward	270	D 2
Stewardson	666	E 4
Stickney	3,317	B 2
Stillman Valley	362	D 1
Stillwell	100	B 3
Stockland	149	F 3
Stockton	1,445	C 1
Stone Park	1,414	*A 2
Stonefort	490	E 6
Stonington	1,120	D 4
Stoy	161	F 5
Strasburg	436	E 4
Strawn	173	E 3
Streator	16,469	E 2
Stronghurst	741	C 3
Sublette	290	D 2
Sullivan	3,470	E 4
Summer Hill	145	C 4
Summerfield	378	D 5
Summit	8,957	B 2
Summum	225	C 3
Sumner	1,170	F 5
Sunfield		D 5
Swan Creek	160	C 3
Swansea	1,816	B 6
Swanwick	154	D 5
Sycamore	5,912	E 2
Symerton	119	F 2
Table Grove	481	C 3
Tallula	527	D 4
Tamalco	50	D 5
Tamaroa	849	D 5
Tamms	665	D 6
Tampico	760	D 2
Taylor Springs	627	D 4
Taylorville	9,188	D 4
Tennessee	249	C 3
Terre Haute		C 3
Teutopolis	919	E 4
Thackeray	100	E 5
Thawville	267	E 3
Thayer	695	D 4
Thebes	541	D 6
Thomasboro	330	E 3
Thompsonville	530	E 6
Thomson	559	C 2
Thornton	1,217	B 3
Tiedtville		A 2
Tilden	906	D 5
Tilton	1,638	F 3
Time	57	C 4
Timewell	184	C 3
Tinley Park	2,326	B 2
Tioga	90	B 3
Tiskilwa	962	D 2
Toledo	905	E 4
Tolono	1,065	E 3
Toluca	1,419	D 2
Tonica	585	E 2
Tonti	100	E 5
Topeka	72	D 3
Torino	9	*E 2
Toulon	1,173	D 2
Tovey	593	D 4
Towanda	400	E 3
Tower Hill	784	E 4
Tremont	1,138	D 3
Trenton	1,432	D 5
Trilla	250	E 4
Trimble	165	F 4
Triumph		E 2
Trivoli	395	D 3
Troy	1,260	B 6
Troy Grove	258	E 2
Tuscola	2,960	E 4
Ullin	773	D 6
Union	435	E 1
Union Hill	138	*E 2
Unionville	140	E 6
Urbain	57	*E 6
Urbana	22,835	E 3
Ursa	400	B 3
Utica	985	E 2
Valier	808	D 5
Valley City	200	C 4
Valmeyer	656	C 5
Van Orin	105	D 2
Vandalia	5,471	D 5
Varna	400	D 2
Venedy	149	D 5
Venice	6,226	A 6
Vera	125	D 4
Vergennes	312	D 6
Vermilion	316	F 4
Vermilion Gr.	200	F 4
Vermont	940	C 3
Vernon	243	D 5
Verona	205	E 2
Versailles	472	C 4
Victoria	469	C 2
Vienna	1,085	E 6
Villa Grove	2,026	E 4
Villa Park	8,821	A 2
Villa Ridge	550	D 6
Viola	826	C 2
Virden	3,206	D 4
Virginia	1,572	C 4
Wadsworth	500	F 1
Waggoner	239	D 4
Walnut	1,093	D 2
Walnut Grove	77	C 3
Walnut Hill	156	E 5
Walshville	113	D 4
Waltonville	459	D 5
Wamac	1,429	D 5
Wapella	504	E 3
Warren	1,378	C 1
Warrensburg	549	D 4
Warsaw	2,002	B 3
Washburn	999	D 3
Washington	4,285	D 3
Washington Park	5,840	B 6
Wasson	300	E 6
Wataga	550	C 2
Waterloo	2,821	C 5
Waterman	750	E 2
Watseka	4,235	F 3
Watson	288	E 4
Wauconda	1,173	E 1
Waukegan	38,946	F 1
Waverly	1,330	D 4
Wayne City	726	E 5
Waynesville	516	D 3
Weldon	492	E 3
Welland	60	D 2
Wellington	300	F 3
Wenona	1,005	E 2
Wenonah	125	D 4
W. Brooklyn	194	D 2
W. Chicago	3,973	E 2
W. City	1,081	E 5
W. Dundee (Dundee)	1,948	E 1
W. Frankfort	11,384	E 6
W. Jersey	75	D 2
W. Liberty	150	E 5
W. Point	275	B 3
W. Salem	902	F 5
W. Union	375	F 4
W. York	250	F 4
Westchester	4,308	A 2
Western Sprs.	6,364	A 2
Westervelt	200	E 4
Westfield	661	F 4
Westmont	3,402	A 2
Weston	150	E 3
Westville	3,196	F 3
Wheaton	11,638	E 2
Wheeler	178	E 4
Wheeling	916	F 1
White City	275	D 4
White Hall	3,082	C 4
White Heath	250	E 3
Whiteash	204	*E 6
Whittington	200	E 5
Wichert	250	F 2
Williamsfield	542	C 3
Williamson	319	D 5
Williamsville	656	D 4
Willisville	635	D 6
Willow Hill	333	E 5
Willow Sprs.	1,314	A 2
Wilmette	18,162	B 1
Wilmington	3,354	E 2
Wilmington (Patterson)	147	C 4
Wilsonville	822	D 4
Winchester	1,591	C 4
Windsor	1,008	E 4
Windsor (New Windsor)	569	C 2
Winfield	714	E 2
Wing	50	E 3
Winkle	114	D 5
Winnebago	752	D 1
Winnetka	12,105	B 1
Winslow	355	D 1
Winthrop Harbor	1,765	F 1
Witt	1,156	D 4
Woburn	110	D 5
Wolf Lake	135	D 6
Wood Dale	1,857	A 1
Wood River	10,190	B 6
Woodbine		C 1
Woodhull	718	C 2
Woodland	334	F 3
Woodlawn	320	D 5
Woodson	211	C 4
Woodstock	7,192	E 1
Woodworth	89	F 3
Woosung	167	D 2
Worden	968	B 6
Worth	1,472	A 2
Wrights	150	C 4
Wyanet	950	D 2
Wyoming	1,496	D 2
Xenia	643	E 5
Yale	153	E 4
Yates City	623	C 3
Yorkville	632	E 2
Zeigler	2,516	D 6
Zenith	59	E 5
Zion	8,950	F 1

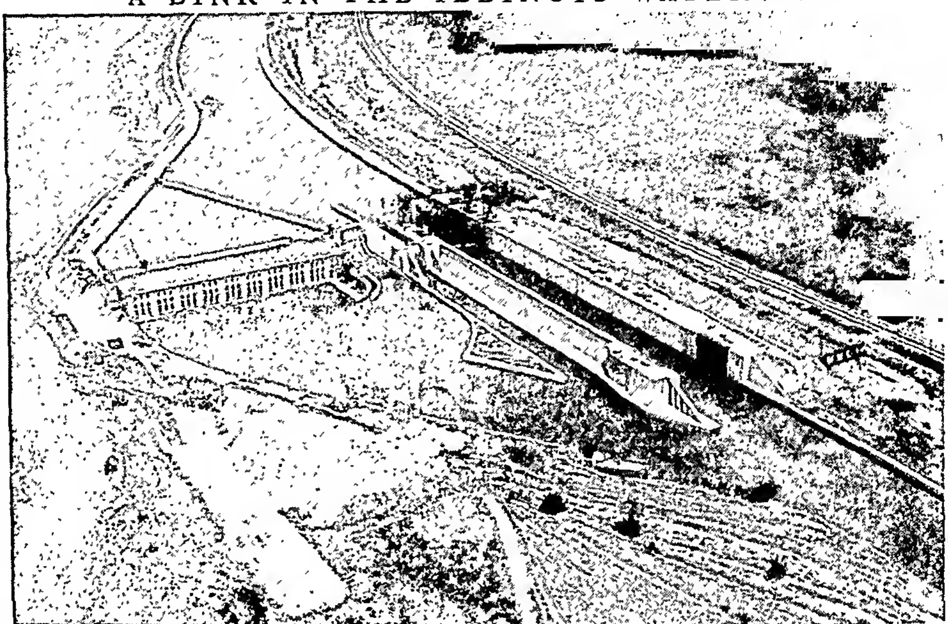
*No room on map for name.

people. Chicago ranks as one of the great cities of the world and is second only to New York in the United States, both in population and in the value of its manufactures. Evanston, Cicero, and Oak Park are the largest of its many suburbs. Near Chicago is the Argonne National Laboratory for atomic research.

Illinois's second largest city is Peoria. It is situated near the center of the state on Peoria Lake, an expansion of the Illinois River. In a rich farm region, with excellent rail and water transportation, Peoria has a great wholesale and retail trade. Nearby coal beds make possible its many and varied industries. Among its leading manufactures are tractors, earth-moving equipment, agricultural implements, and commercial alcohol and alcoholic liquors (*see* Peoria).

Springfield, the capital of Illinois, is a beautiful city laid out with wide and well-shaded streets, with the public square and courthouse in the center. The state capitol is one of the finest public buildings in the Middle West. Located in a rich agricultural district, Springfield is an important railroad center handling large shipments of coal, grain, livestock and many manufactured articles. (*See* Springfield, Ill.)

A LINK IN THE ILLINOIS WATERWAY



This Fairchild air view shows where the Chicago Sanitary and Ship Canal—popularly called the Drainage Canal—joins the Des Plaines River at Lockport. The generating plant at the left provides electricity for the city of Lockport. Through the locks at the right a steadily increasing flow of traffic, amounting to several million tons annually, passes down the Illinois River to the Mississippi.

East St. Louis, situated on the Mississippi River opposite St. Louis, Mo., is connected with that city by great steel bridges. It is the western terminus of many eastern railroads. Its industries include meat packing, steel works, flour mills, and aluminum works. Other important cities are Rockford, one of the nation's great toolmaking centers (*see* Rockford); Elgin, famous for the manufacture of watches and clocks; Joliet, which contains some of the largest steel plants in the country; Rock Island, famed for its arsenal, which is one of the leading armament-producing plants in the nation; and Decatur, Aurora, and Quincy, important manufacturing cities.

Illinois schools and colleges are justly famous, and the state stands near the top in the amount it spends on education. The state maintains the University of Illinois at Urbana and Chicago, Southern Illinois University at Carbondale, and state teachers colleges at Normal, DeKalb, Charleston, and Macomb. The University of Chicago, founded by John D. Rockefeller, Sr., and Northwestern University, located at Evanston, are among the largest and best-known institutions in the country. There are more than 40 other colleges and universities of recognized standing.

The Government of Illinois

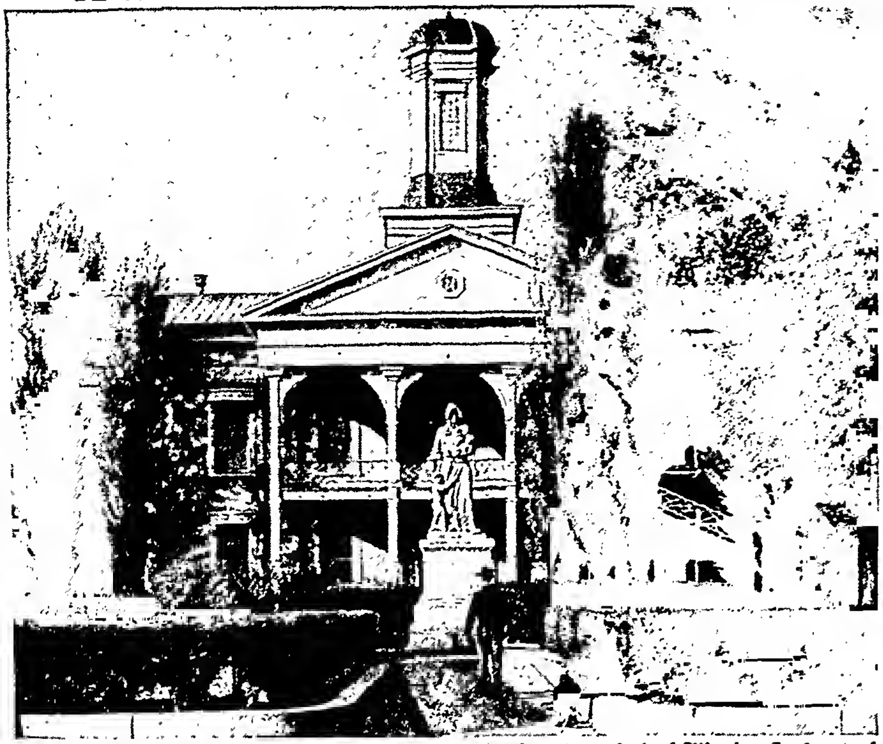
Illinois has had three constitutions, adopted in 1818, 1848, and 1870. The present constitution restricts the powers of the legislature, and the constitution cannot be changed except by an amendment passed by two thirds of the legislature. The amendment must be ratified by a majority of those voting at the election or two thirds of those voting on the proposition, whichever is smaller. Only three articles of the constitution may be amended during a session of the legislature. This procedure makes it difficult to achieve needed governmental improvements.

The state is divided into 51 senatorial districts; each district elects one senator and three representatives. The voter may vote for each of three candidates for representative, or give one and one-half votes to each of two, or three votes for one. Thus a minority party may elect or defeat a candidate.

In 1917 Illinois took a great step in administrative reform by organizing its more than a hundred appointive commissions and officials under nine departments—finance, agriculture, labor, mines and minerals, trade and commerce, public health, registration and education, public works, and public welfare.

Because of the origin of the early settlers, Illinois has three county types. Seventeen southern counties are of the Virginia type, with a board of three commissioners. County-township government exists in the northern part of the state, with a board of supervisors from the townships according to population. Lastly, there is the case of Cook County, which has

ILLINOIS' OLDEST STANDING CAPITOL



The Vandalia State House, built in 1836, was the fourth capitol of Illinois. In front of the white brick building stands the Madonna of the Trail monument. It commemorates the old Cumberland Road which had its western terminus in Vandalia.

15 commissioners, 10 from Chicago and 5 from the remainder of the county. There are also districts, like the Sanitary District, which have taxing power.

Early History of Illinois

The first white men to see the Illinois prairies were Joliet and Marquette. They came up the Illinois River in 1673 and named the country after the "Illini" Indians. By 1750 the region contained some 2,000 French fur traders, settlers, missionaries, and soldiers, with a few Negro slaves. They lived in and near Kaskaskia at the mouth of the Kaskaskia River, at Cahokia, just south of the present city of East St. Louis, and other small posts. (*See* Joliet; La Salle; Marquette.) Title to the region passed to Great Britain in 1763, after the French and Indian War.

During the Revolution, George Rogers Clark was sent to seize the Northwest. With his "Long Knives" (Kentucky frontiersmen), Clark captured Kaskaskia and Cahokia in 1778. The Northwest then became a county of Virginia (*see* Clark).

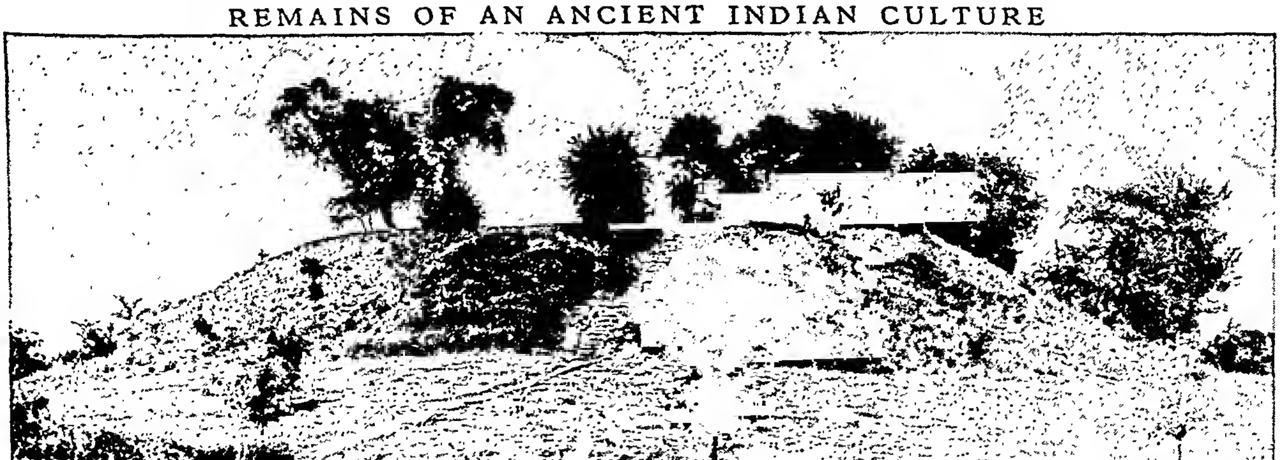
Territorial government was established in 1787 (*see* Northwest Territory). Two years later the region between the Ohio and the Illinois rivers west of the Wabash became St. Clair County, with Cahokia as its capital. In 1800 Illinois became part of Indiana Territory. On Feb. 3, 1809, Congress set up Illinois and all the territory north to Canada as the Illinois Territory, with its capital at Kaskaskia, and Ninian Edwards as governor.

The opening of the lead mines at Galena in 1826 attracted hundreds of people. Until 1830 most immigrants came from the South and settled below the Illinois River. Thereafter, settlers came in greater numbers through Chicago.

From Statehood to the Civil War

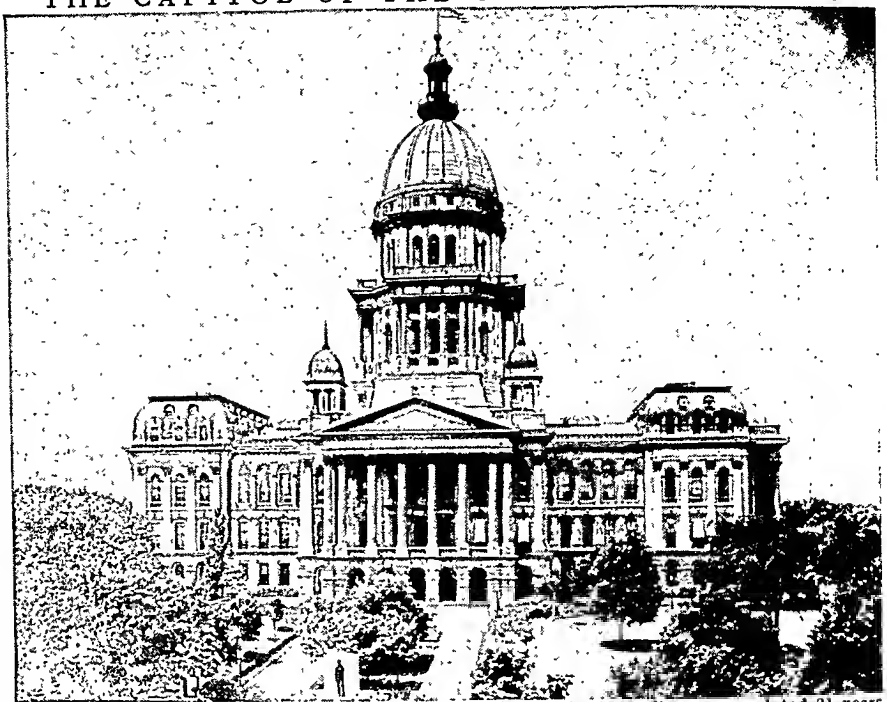
On Dec. 3, 1818, Illinois was admitted as a state. Nathaniel Pope, the delegate to Congress, overcame strong opposition and succeeded in having the northern boundary set at 42° 30′ instead of at 41° 39′. By this change a 60-mile strip, the site of Chicago, became part of Illinois instead of Wisconsin. The north end of the state, was able to outvote the proslavery southern end to prevent the legalizing of slavery in 1824. Vandalia was the capital from 1820 to 1837. Then Springfield was selected, and the legislature held its first meeting there in 1839.

REMAINS OF AN ANCIENT INDIAN CULTURE



The Indians who once roamed across the Illinois prairies built thousands of earth mounds like the one shown here. This mound, in Cahokia State Park near East St. Louis, supported a building where religious ceremonies were held. Other mounds served as burial grounds. The largest in the Cahokia group, Monks Mound, covered 16 acres and reached a height of 100 feet.

THE CAPITOL OF THE STATE OF ILLINOIS



This is the imposing State Capitol in Springfield. Begun in 1868, it was completed 21 years later at a total cost of more than $4,000,000. This is the sixth capitol in the history of the state, and the second built in Springfield.

The rapid settlement of the northern part of the state provoked the Black Hawk War in 1832. In 1837 the state began ambitious improvements, halted by the panic of that year; but the Illinois and Michigan Canal and a short steam railroad, the Northern Cross, were constructed.

From 1850 to 1876 Illinois was especially prominent in national affairs. Senator Stephen A. Douglas in 1850 obtained a liberal land grant for the building of the Illinois Central Railroad. It was completed in 1856, and in the following year Chicago was linked by rail with the East. The Lincoln-Douglas debates in 1858 drew the attention of the whole country (*see* Lincoln-Douglas Debates). Lincoln, who led the nation through the Civil War, and Grant, who commanded the Union armies to victory, were both Illinois men. Grant later served as president of the United States. Another native son who won fame as a military leader in this conflict was Gen. John A. Logan.

Development of the Modern State

Following the Civil War agricultural production grew rapidly, but industrial expansion made even greater strides. The rapid rise of industrialization brought on a number of strikes and riots. Two of these were a riot in Chicago's Haymarket Square in 1886 and the Chicago Pullman strike in 1894. Champion of the working man during these troubled times was Gov. John P. Altgeld. His term as governor (1893–97) was the only Democratic administration in Illinois between 1857 and 1913.

Later legislation helped to improve relations between labor and management. The General Assembly passed a child-labor law in 1891 and a 10-hour law for women workers in 1909. A new 8-hour law replaced the old statute in 1937. The legislature also established free state employment agencies in 1899 and the first workmen's compensation act in 1911. A new child labor law took effect in 1947. Illinois carried out many reforms in its state government. It enacted the Australian ballot in 1891 and direct primaries in state elections in 1910. An effort to call a constitutional convention in 1949 failed, but in 1950 the voters approved the Gateway Amendment, making it easier to amend the constitution. (*See also* chronology in Illinois Fact Summary; United States, section "North Central Plains.")

MEMORIAL TO A CIVIL WAR HERO

When Gen. Ulysses S. Grant returned from his victories in the Civil War, the city of Galena presented him this house as a gift. Today the state of Illinois maintains the house as a memorial to Grant. Its furnishings are heirlooms of the Grant family.

ILLUSIONS. For more than two thousand years the Parthenon at Athens has been man's ideal of architectural beauty. The eye delights especially in the simplicity of its apparently straight lines. Yet in reality the Parthenon contains no straight lines at all. Wisely, the architects made its columns taper toward the top not in a straight line, but with a slightly convex or bulging curve; and they also made its seemingly horizontal lines curve almost imperceptibly, according to a careful mathematical scheme. They knew that the eye deceives, that straight lines, viewed from certain angles, appear curved—so they curved the lines in just the right manner to make them appear straight. They understood the principle of optical illusion.

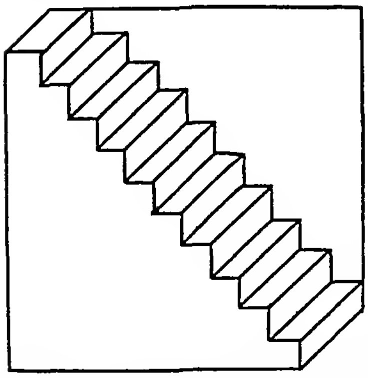


Fig. 1. Is this the top side or the under side of the cellar stairs? Watch it change.

All our senses are subject to this trick of illusion. Moving pictures, for example, are based on optical illusions. Objects in them do not move, but instead we see a series of pictures shown in such rapid succession that they seem to move. We see strange shapes in the fog and hear imaginary voices in the shrieking of the wind.

Various explanations of illusions have been offered. In general it may be said that in an illusion there is always some circumstance which throws off the normal process of perception and prevents accurate judgment.

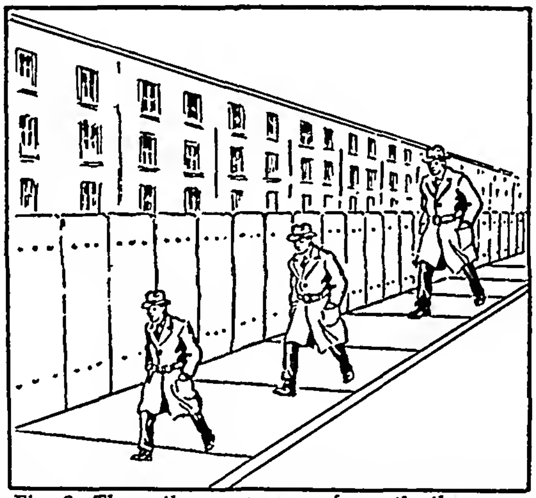


Fig. 2. These three men are of exactly the same height. But we are so used to allowing for perspective that the last man seems a giant.

Fig. 1 is a good example of an optical illusion. Does it represent the top side or the under side of a flight of stairs? As you look at it, it will change like magic from one to another. Actually it is only a grouping of straight lines. But in real stairs, as in most objects, we see three dimensions, and so we immediately associate depth with these lines and liken them to the stairs with which we are familiar. The shift of "appearance" takes place in our brain.

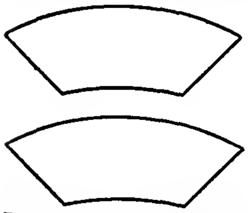


Fig. 3. The two shapes are of identical size. The upper seems smaller.

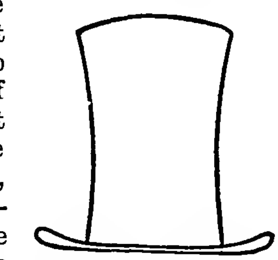


Fig. 4. This high hat is no taller than its brim is wide—believe it or not!

Perspective, which makes distant objects appear smaller than near ones, causes the puzzling illusion in Fig. 2. You may need to measure the figures to convince yourself that they are identical in height. Yet the picture of the man in the rear, who appears to be a giant, is really no taller than the picture of the little man who leads the procession. (*See* Perspective.)

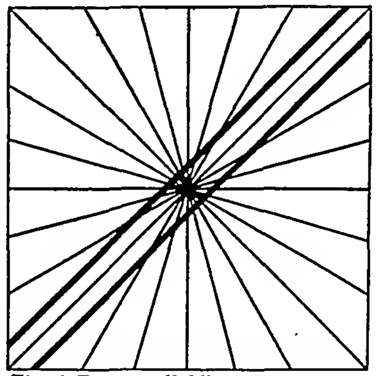


Fig. 5. Two parallel lines do not seem parallel when the eye is confused by the spider-web.

You may make a game of Fig. 3, in which the lower diagram appears to be larger than the upper one. Cut two such identical shapes out of a folded sheet of paper, then slide them about, exchanging their positions. They will seem to change size before your eyes. The upper one seems smaller because the eye, instead of comparing its lower line with the lower line of the other drawing, compares it with the longer arc which is nearer.

Equally baffling is the drawing of a hat in Fig. 4. Though it appears so tall, it is really no taller than the width of its brim. Two factors enter into the illusion. First, our tendency to see vertical lines as longer than horizontal. Second, our tendency to see a broken or intercepted line as shorter than an unbroken one.

Fig. 5 illustrates our tendency to view objects as a whole rather than to isolate certain parts of them with the eye. Surely the two heavy diagonal lines bulge at the center of the drawing! But they are really perfectly straight and parallel.

The eye travels rapidly along a line, in ordinary perception. When this continuity is interrupted, we are confused; and so, as we look at Fig. 6, we find it hard to see the diagonal lines as parts of a straight line reaching from corner to corner of the figure.

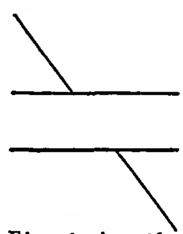


Fig. 6. Are the diagonals both in one straight line?

Look at Fig. 7 on the next page. At first glance you will say that the white square below is larger than the one above; yet they are really exactly the same size. The wide black border

so dwarfs the central white space that we naturally, in the comparison, underestimate its true size.

Fig. 8 shows one form of the famous "arrow-head and feather" illusion. In A the horizontal line is divided exactly in the center, as you can see by comparing it with C; yet the right-hand portion seems much longer than the left-hand. Photographs of the eye movements of a person looking at this figure show that the converging lines at the left cause the eye to stop short of the true length of the horizontal line, while the diverging lines at the right cause the eye to move too far. The eye movements are shown by the dotted line in B.

Fig. 7. The two white squares are identical in size, but the eye includes the border which dwarfs the upper white square.

Not all illusions are visual or optical. Construct a box of very thin wood 12 inches each way and another box $1\frac{1}{2}$ inches each way. Put into the smaller box enough metal to make it weigh exactly the same as the larger box. When you pick up the larger box it will seem much lighter. We are in the habit of interpreting size as weight because the larger of two like objects is nearly always the heavier.

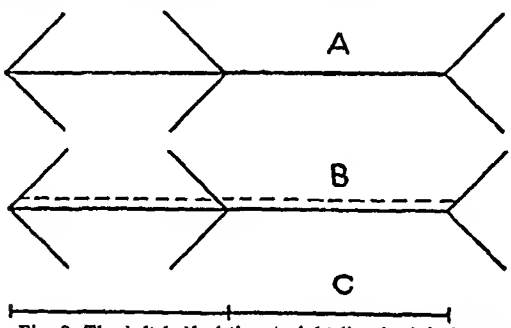


Fig. 8. The left half of the straight line in A is just as long as the right half, though it seems shorter, because the dotted line in B is the one followed by the eye. C shows the line unconfused by the "arrow-head and feather" illusive lines.

Most famous of all illusions is the one in Fig. 9, which is called the Aristotle illusion because it was first discovered by that philosopher. Place a marble or pencil between the crossed fingers. You will seem to feel two objects instead of one. In our ordinary experience the opposite surfaces of two fingers never touch one object at the same time. So trained are their nerves in this regard that they mistake the strange stimulus given them here and transmit a deceptive message.

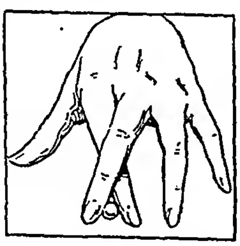
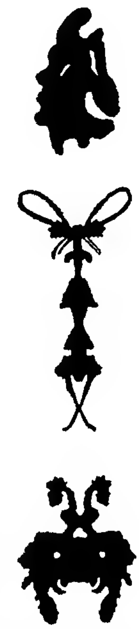


Fig. 9. Hold a small marble as shown above and you will feel two marbles instead of one, a tactile illusion.

IMAGINATION. It is pleasant to lie on the grass on a warm spring day and gaze up at the clouds, seeing in them first a face, then an animal, then another object and another. In these reveries we are duplicating one of the famous experiments carried on in the psychological laboratory. There the person taking the test must look not at clouds but at ink blots like those pictured here and write down, within a given time, as many as possible of the things he sees. It is imagination which enables one to see things not actually in the ink blot or the cloud.

Thinking, when it concerns itself with objects or events outside our personal experience, is imagination. Sometimes imagination is defined as the making of new combinations of old experiences. I remember the horse which I saw yesterday and likewise the man. But if I put the horse and the man together and think of a mysterious creature with the body of a horse and the head of a man, I am imagining. Even the writer of the most fantastic tales puts elements of past experience into his characters. Though he may write about one-eyed monsters, three-legged men or Lilliputians, his characters throughout are made up of elements which we all know. Eyes, legs, smallness are not new; the combination only is new.



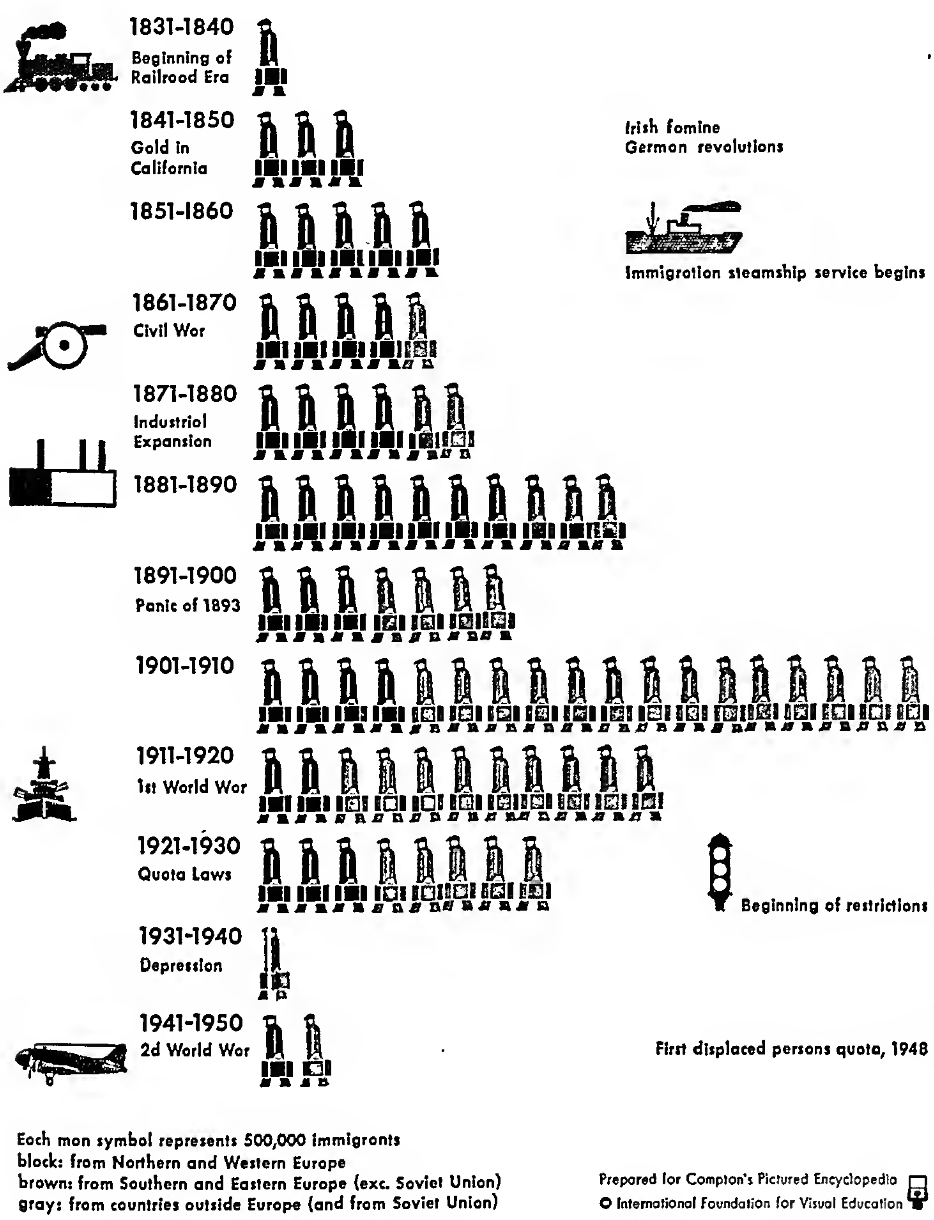
A drop of ink pinched into a fold of paper makes queer silhouette pictures. Why do they look like pictures? Just your imagination.

Imagination plays an important part in the kind of thinking which solves a practical problem. The fancies which enable an Edison to give the world an electric light represent imagination brought into control and made to work to a useful end. If we are puzzled about where to get the wheels needed to make a scooter and suddenly think of taking them off an old roller skate, we are using this same kind of imagination.

In almost any line of endeavor, imagination of the kind which gets results is necessary. It is made up of two factors. First is the ability to think of new combinations of experiences. Second is the ability to select those combinations which are best. The person who has only the first of these is a flounderer and a failure. The person who can criticize but cannot strike out new ideas is equally handicapped. Modern scientific method has added a third requisite to these two—experiment or test to answer the practical question, "Will it work?"

In science, discovery, and invention, in art and literature and business, these three processes are at work—imagination, self-criticism, and experiment or test. All progress depends on the extent to which man can apply these three functions to the work at hand and profit by relating them.

The Rise and Fall of Immigration into the United States



IMMIGRATION. Only the Indians can properly call themselves native Americans, and even they are believed to have come from Asia centuries ago. All the rest of the people of the United States are immigrants or the descendants of immigrants. For the first time in its history the United States drastically restricted the flow of immigration during the 1920's. At that time about one out of every three people was either foreign born or of foreign or mixed parentage. Since then the proportion of such people to native born has gradually diminished.

America was peopled by Europeans who came to the New World to find freedom: religious freedom, political freedom, and economic freedom. Puritans and Pilgrims, Catholics, Quakers, French Huguenots, and German Mennonites all found a religious as well as political haven in the New England and middle colonies. To the southern colonies came traders and settlers eager to seek relief from economic stress. Most of this immigration came from the British Isles. In 1790, the first United States census indicated that nearly 90 per cent of the white people were of British descent; and nine tenths of those of British descent were English (*see* American Colonies)

Up to 1820 immigrants came at the rate of perhaps five or six thousand a year. After 1820 the rate steadily increased, until by 1830 new arrivals numbered more than 20,000 yearly. They started coming from the continent of Europe, just as the colonists had done, to escape political and religious persecution and poverty. The tide continued to swell until in 1854 it reached the prodigious number of 428,000.

Sturdy German farmers swarmed into Illinois, Wisconsin, and Missouri as early as 1830, when land sold at $1.25 an acre. Norwegians and Swedes followed them during the next few decades, and many of them found new homes amid congenial surroundings in Minnesota, the Dakotas, and Wisconsin.

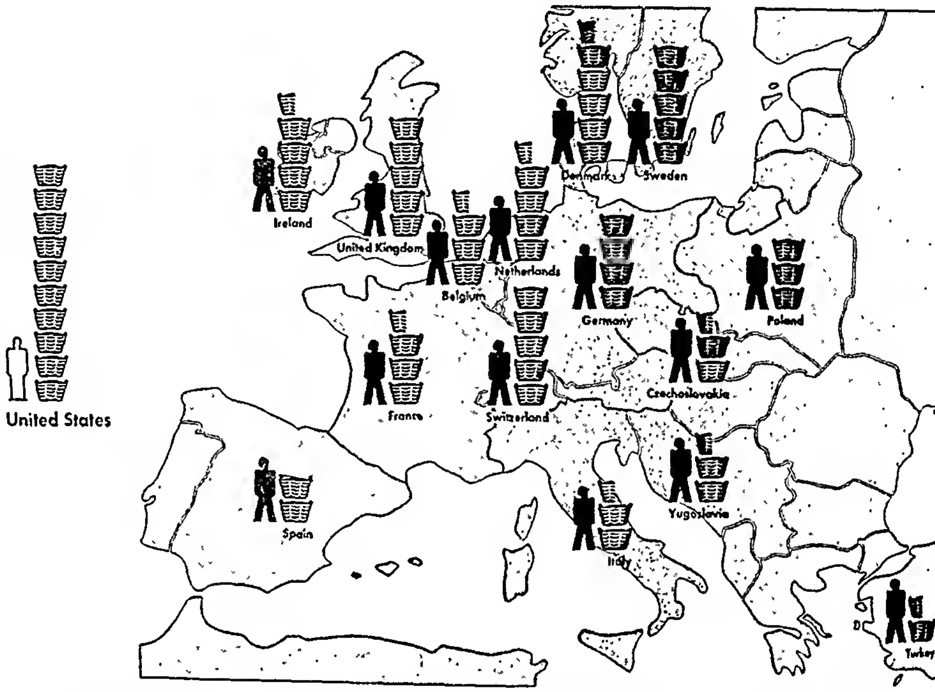
Famine in Ireland in the early 1840's, brought on by the failure of the potato crop, caused the death of thousands from privation. American relief ships sent to the impoverished isle with food returned laden with immigrants. These newcomers settled first in New York City and Boston; some furnished unskilled labor for factories and mines; others drifted west with construction gangs. The Irish were ambitious, especially for their children. Parents made sacrifices to keep their boys and girls in school and they took pride in seeing them fill political offices and other positions of importance.

Refugees Seeking Safety

At about the same time, the collapse of a revolutionary movement in Germany forced thousands of bold spirits to seek safety in America. These refugees were men and women of lofty ideals. Many were university students or graduates. Those who sprang

from the soil were excellent farmers. They brought with them their continental customs and their music, and have left an indelible impress on such cities as Chicago, Milwaukee, Cincinnati, and St. Louis. In succeeding decades the German and Irish tides united with those from Denmark, Norway, and Sweden.

The Magnet of High Wages in the United States



Each complete basket represents 10 per cent of average real wages in the United States in a typical year

This chart shows the strongest attraction drawing immigrants to America. By coming, they hoped to double or triple their real wages—that is, the goods which they could buy with their earnings.

Immigration was slowed up by the Civil War though in the midst of this conflict, Lincoln launched a plan to stimulate it and to find new settlers for the frontier states. Free homesteads were offered to any foreigner who would take out his first citizenship papers. In 1864 a commissioner of immigration was installed at Washington, with an assistant in New York, to scatter information about free lands and to assist arriving home seekers. Many of the states made special efforts to attract settlers and even sent agents to European ports of embarkation to recruit them. Western railroads competed with the states to induce immigrants to take up the land which had been granted the roads by the government to finance their construction work.

Farm Workers Were Welcomed

A further impetus to European immigration was brought about by agricultural distress on the continent in the 1880's. Wheat from Minnesota and the Dakotas was underselling European grain even in the district where it was grown, and the European farmer was bankrupt. At the rate of 500,000 a year, the agriculturists of northwestern Europe poured into the Mississippi Valley and toward the Pacific coast.

At first, the United States held out open arms to the stranger. There were canals to be dug, railroads to be built, minerals to be mined, forests to be cut, farm lands and prairies to be cultivated, great industrial plants to be manned. Until the 1880's immigrants were drawn principally from northwestern Europe. These Irish, Scots, Swedes, Norwegians, Danes, Dutch, and Germans mingled well with the people already here. They brought their families with them. They were eager to become citizens. Stalwart, courageous, and upstanding, they were, as a rule, intelligent, educated, and skilled in the use of tools.

About 1882 a significant change came about in the character of the immigration. Arrivals from southern and eastern Europe, which had numbered only one-tenth of the total, began increasing. Twenty-five years later this proportion had increased to eight-tenths. Italians, Russians, Lithuanians, Ukrainians, Poles, Greeks, Bohemians, and Hungarians came in ever greater numbers, and from 1905 till the first World War, a million a year entered the United States.

The "new immigration" differed from the old in several respects. Some were men who had left their families in Europe and planned to return to them when they had saved a little money. Most of the new immigrants settled in the large cities where they found work only in the hardest and lowest paid jobs. Many had little or no education. Faced with such employment and language handicaps, they tended to congregate in parts of communities with their own people. In these cities within a city many clung to their Old World customs thus further delaying Americanization. Unscrupulous politicians gained votes by making special appeals to national groups. Another result was that many foreign-language communities became badly overcrowded and degenerated into slums.

Despite these handicaps many stayed to marry, rear families, and become loyal American citizens. The American people, however, became concerned about the open-door policy. In 1882 the first restrictive law was passed. It excluded such undesirables as lunatics,

WHERE THE PEOPLE OF THE UNITED STATES CAME FROM

National Origins of the

White Population in 1790

Each complete symbol represents 1 million people

The first United States census (1790) showed that the great majority of the people were of British (chiefly English) descent.

idiots, convicts, immoral persons, paupers, and persons likely to become public charges. Three years later, the Alien Contract Labor Law prohibited American employers from importing workmen from Europe under contract. (Actors and artists of distinguished merit, professional lecturers, singers, nurses, ministers, and others are exempt from this law.) An act of 1917 required a literacy test for immigrants over 16 years old. An act of 1918 excluded anarchists and members of any group that advocated the overthrow by violence of the United States government. All these restrictions barred only 1.4 per cent of the total number of aliens seeking admission. The gate was still open for any number of qualified applicants.

The first World War revealed the presence of national groups that had failed to become assimilated. The end of the war brought about a wholesale exodus from war-stricken countries. In 1920, 430,000 entered the United States from Europe; in 1921, 800,000. Unemployment was now widespread in America and the flood of immigrants added to the difficulties. Farmers as well as organized labor wanted immigration curtailed. Other groups pressed for restrictions on a cultural rather than an economic basis.

The Quota Laws

In 1921 Congress applied the first effective brakes by passing a *quota law*. This limited the number of immigrants from any European country to 3 per cent of the nationality in the United States in 1910. The quotas had the effect of restricting immigration from southern and eastern Europe in favor of the northern groups. Under this law the numbers admitted reached half a million by 1923 but the era of unlimited immigration had come to an end. The Promised Land was no longer open to all.

The law of 1924 reduced the quotas to 2 per cent, based on the 1890 census. This restricted the number of immigrants to 180,000 the next year. The 1924 law and later amendments, effective in 1929, fixed a *total annual quota* of 150,000. The 1920 census was now taken as a base. If a given nationality contributed 10 per cent to the 1920 population, it was allotted 10 per cent of the total quota, or 15,000. No country was given a quota of less than 100. Great

National Origins of the

Foreign-Born Population in 1950

Each complete symbol represents 100,000 people

The last census of population taken in the United States (1950) showed that about one fifteenth of the people, slightly more than 10 million, were born outside the boundaries of the nation.

Britain and Northern Ireland received a quota of 65,721; Germany, 27,370; southern Ireland, 17,853; Poland, 6,524; and Italy, 5,802. For all other countries the quotas fell below 4,000. Quotas granted to oriental countries applied only to non-orientals born in these countries, since the act excluded all orientals as ineligible to citizenship.

Non-Quota Immigrants and Visitors

Foreign-born wives and husbands of American citizens and their children (under 18 years of age) are admitted without quota numbers. Aliens once legally admitted are allowed re-entry after a visit abroad. Ambassadors, consuls, and government officials are admitted freely with their families and servants.

Visitors' visas, granting entry for a limited period, are given to tourists, students, merchants, ministers, and professors. If the visitor decides he wants to remain permanently in the country, he must first leave the United States temporarily to obtain a quota number and visa (the right of admission). This is necessary because the law stipulates that only an American consul can give quota numbers and visas; and there are no American consuls in the United States. Before leaving, the visitor may take a pre-examination to ascertain whether he will be readmitted when he returns for permanent stay. The pre-examination procedure was set up in 1936 to handle the cases of refugees from persecution in Germany.

LAST IMMIGRANTS DETAINED AT ELLIS ISLAND

More than 20,000,000 aliens, like those pictured here, passed through the doorways of Ellis Island in 62 years. The famous immigration station—often called the "golden door"—was opened in 1892 and closed in 1954.

Immigration from the Western Hemisphere

Immigrants from Canada and Mexico and from Cuba, Haiti, the Dominican Republic, and the independent countries of Latin America are exempt from quota restrictions. When immigration from Europe fell off, Mexicans entered in large numbers to fill the demand for common labor. The peak was reached in 1927, when 77,000 came in. During the depression of the 1930's, the rule against admitting persons likely to become public charges reduced the inflow to two or three thousand a year.

During the second World War, the South faced a shortage of agricultural laborers caused by the movement of Negroes to the industrial north. In 1942 the United States made an agreement with Mexico opening the borders for the temporary migration of Mexican farm laborers. The laborers entered under contract. At the conclusion of the contract they were obliged to return to Mexico.

Immigration of Oriental Peoples

Immigration from China and Japan presented a different problem. Chinese began coming to the Pacific coast in numbers after the 1849 gold rush to California. They did the hard labor in mines, on ranches, and in railroad construction. At first they were welcomed, but opposition grew after the hard times of 1873. White men were out of work, while the Chinese were employed because they worked longer hours for less pay. Anti-Chinese riots in 1880 brought matters to a crisis. In that year a treaty with China barred Chinese coolies (laborers) from the United States. This was supplemented in 1882 by an act of Congress which excluded Chinese from naturalization. This act was later interpreted to apply to all Asiatics.

In the second World War China's heroic stand on the side of the United Nations changed public opinion. The Chinese exclusion law was repealed in 1943. The new act admitted 105 Chinese a year on a quota basis, and made all Chinese living in the United States eligible for naturalization.

Immigration of Japanese coolies in the 1900's stirred the Pacific coast to alarm of a new "yellow peril." In 1906 the San Francisco school board ruled that Japanese children must attend the Oriental school in Chinatown. When Japan protested this and new federal restrictions, President Theodore Roosevelt in 1907 made a "gentlemen's agreement" by which Japan promised to stop issuing passports to workers of the coolie type. But by 1924 so many other Japanese had settled on farms on the Pacific coast that Congress barred the immigration of all aliens not eligible for citizenship.

Ellis Island No Longer Used for Immigrants

Today no immigrants pass through Ellis Island in New York Harbor, where incoming aliens were formerly examined. In 1954 the immigration station there was closed. United States Public Health physicians examine aliens before they leave the ship, and immigration officers order the return of the physically or mentally diseased.

Ellis Island was last used as a place of detention for aliens about to be deported. Many were detained there for months awaiting final arrangements. Aliens may be deported if they entered the country

illegally; if they have become paupers; if they have been convicted of crime; or if they are members of a group advocating overthrow by violence of the government of the United States. Once deported, they may not return. Aliens who have lived in the country less than five years may choose to be returned to their homeland at the expense of the United States government if they need public aid. During the depression years between 1930 and 1940, there were 46,000 more departures than arrivals.

Immigration Service and Border Patrol

Control of immigration was first vested in the Department of Commerce and Labor. In 1913 it passed to the new Department of Labor. In 1940 the Immigration and Naturalization Service was made a part of the Department of Justice.

The Border Patrol of the Immigration Service guards the coasts and the Canadian and Mexican borders against illegal entrants. The patrols may board and search any ship within United States territorial waters, railway cars, airplanes, and automobiles.

World Immigration Problems

Australia, Canada, South America, and other thinly populated regions long encouraged immigration, barring only the physically and mentally unfit, people who were likely to become public charges, and in some cases Orientals. Crowded countries, on the other hand, frequently helped their surplus peoples to emigrate to their overseas possessions or to other countries.

This free movement of peoples from country to country passed with the first World War. Thereafter nations all over the world drastically restricted immigration. When the second World War visited Europe with chaos and destruction, millions of despairing people would have emigrated. But no country would admit more than a few selected immigrants. And in Europe itself many governments set up barriers to emigration. The Soviet Union allowed no one to leave the country—not even Russian women who had married foreigners. Spain also completely barred emigration. Poland, faced with a labor shortage, granted no exit permits. The Italian government favored emigration but could find few outlets.

Most helpless of all the would-be immigrants were the "displaced persons," those stranded in alien lands with all homeland ties broken. In 1947 these people still numbered about one million. Most of them came from lands that had passed under Communist domination—Poles, Balts, Ukrainians, and Yugoslavs. About one fifth were Jews. Many of these emigrated to the new state of Israel after 1948 (*see* Israel).

For years the United States immigrant quota had not been filled. From 1929 through 1947 an average of less than 50,000 a year entered. People in nations with high quotas did not want to leave, and quotas cannot be exchanged between countries. From 1948 to 1951 the United States admitted 415,744 "displaced persons" in addition to those who came in under the regular quota system. Many former members of Axis societies were barred.

In 1952 Congress passed the McCarran-Walter bill, which did little more than bring together existing immigration and naturalization laws. The act fixed the total annual number of immigrants at 154,657 and retained the 1920 census base for immigration quotas, but each nation was granted a quota of at least 100. In 1953 Congress voted to admit over a three-year period 214,000 additional immigrants, chiefly refugees from Communist countries.

IMMORTELLE. These odd plants with dry, papery flowers and stiff erect stems are common garden plants in most parts of the world. In ancient times a few species, originally used as decorations for graves, were grown in the lands along the Mediterranean. There the favorite kind was a yellowish-white flower, which was sometimes dyed before being made into bouquets, wreaths, or crosses.

The commonest of the immortelles (or everlastings) are the strawflowers (genus *Helichrysum*), which have crisp orange, maroon, yellow, and white bracts, and are used in winter bouquets. These plants grow best in an open location. They reach a height of about 20 inches. The flowers are gathered before the scale-like leaflets are fully expanded so that the dried heads will retain a half-open appearance. Other everlastings are the ammobium, or winged everlasting, with yellow flowers; the anaphalis, or pearl everlasting, with gray-white clusters of small flowers; and the xeranthemum, or common immortelle, with lilac or rose flowers. This last is perhaps the earliest plant called "immortelle."

All the plants mentioned above are members of the composite family. Some everlastings belong to other plant families. Among them are the white or red clover-like globe amaranths (genus *Gomphrena*), the wiry clusters of the sea pinks, or statice (genus *Limonium*), and certain ornamental grasses.

IMPEACHMENT. The word "impeachment," from old English law, usually means a formal accusation brought against a public official with the object of removing him from office. The act of impeachment lies in the accusation itself, and a man is said to have been "impeached" even if acquitted of the charge. The Federal Constitution makes the president and all other civil officers of the nation subject to impeachment for "treason, bribery, or other high crimes and misdemeanors." The House of Representatives by majority vote must bring the impeachment (that is, make the accusation). The Senate, sitting as a court of impeachment, tries the case and judges the officer's guilt. There is no appeal from its decision. The penalty in case of conviction is removal from office and disqualification for further public service. A number of impeachment cases have come before the Senate (*see* table in Index). One was that of a president—Andrew Johnson—who was acquitted.

Impeachment is provided for in the constitutions of most of the states also. It has been superseded to some extent by the "recall," which in some states allows the voters to vacate any office before the expiration of the officeholder's term.

INCAS. When Pizarro and his gold-hungry followers reached Peru in 1532, the rich Inca empire stretched from the Pacific across the Andes and from Ecuador 3,000 miles southward to central Chile. The Incas, a Quechua-speaking tribe, had conquered this vast territory in a single century. They controlled its people with a highly organized government of which they were the ruling caste.

In their capital, at Cuzco in Peru, lived the emperor—called "The Inca"—who was regarded as a god on earth. The nobles were a strong and gifted group. They developed among the people great skill in handicrafts, building, and architecture, and they accumulated fabulous wealth in gold and silver.

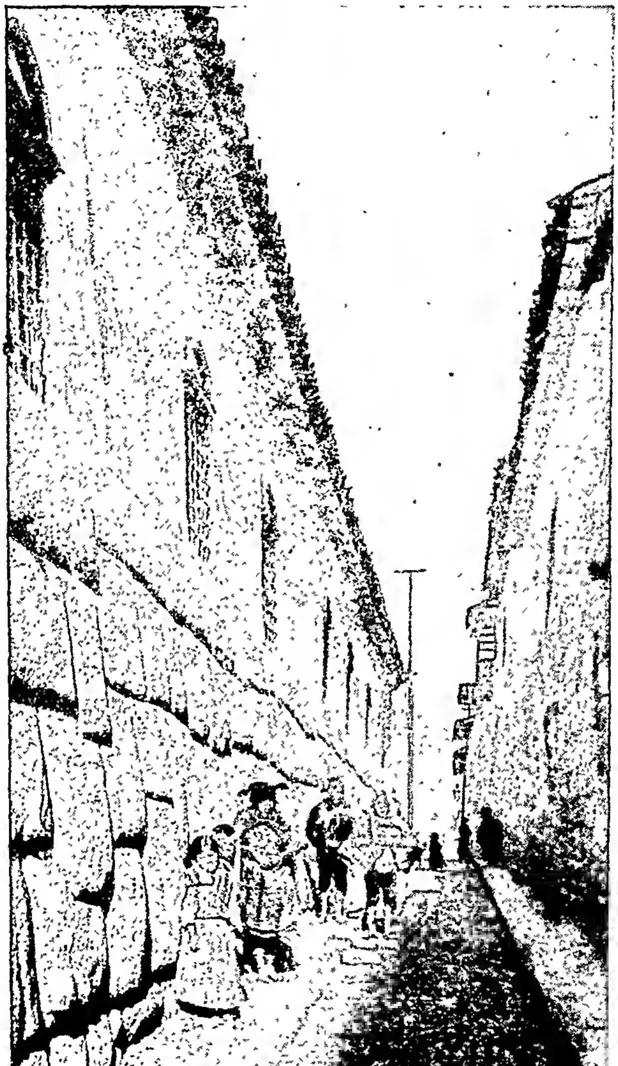
Many remains of Inca civilization may still be seen scattered over the central highlands of the Andes Mountains. Above Cuzco, tower stupendous ramparts made of individual stones of prodigious size—some 20 feet high and weighing many tons. No mortar was used, yet after centuries these stones lie so perfectly fitted together that it is impossible to insert the blade of a knife between them. Terraced fields, some of more than 50 "steps," still climb the mountainsides; and stone causeways several miles long show that irrigation was practised extensively.

Incas were ignorant of writing; but they kept records by means of knotted cords (called *quipus*), the knots being of various kinds and colors. These cords are supposed to have recorded crop production, and to have been used as a basis of taxation. If crops failed in one locality, the government's records would show where produce was more abundant, and the shortage could be made good by drawing on public warehouses in those districts. To the farmers of the Inca empire we owe the potato, and they also had a hand in improving other wild plants. Among their important crops were Indian corn, sweet potatoes, and cassava. Of all the American Indians, only the Incas had draft animals. They used llamas as mounts and as beasts of burden.

The craftsmen practised every style of hand weaving we know today. They also knew how to smelt metals and cast in molds; and in the making of pottery they were artists. Evidently, also they had made some progress in music, for among the remains of their civilization are found flutes made of bone and of cane, clay trumpets and trumpets of shells, bells of different tones, some made of bronze, some of pure copper. They built paved roads, with suspension bridges and posthouses at intervals over the wildest mountain ranges and through the desert for hundreds of miles.

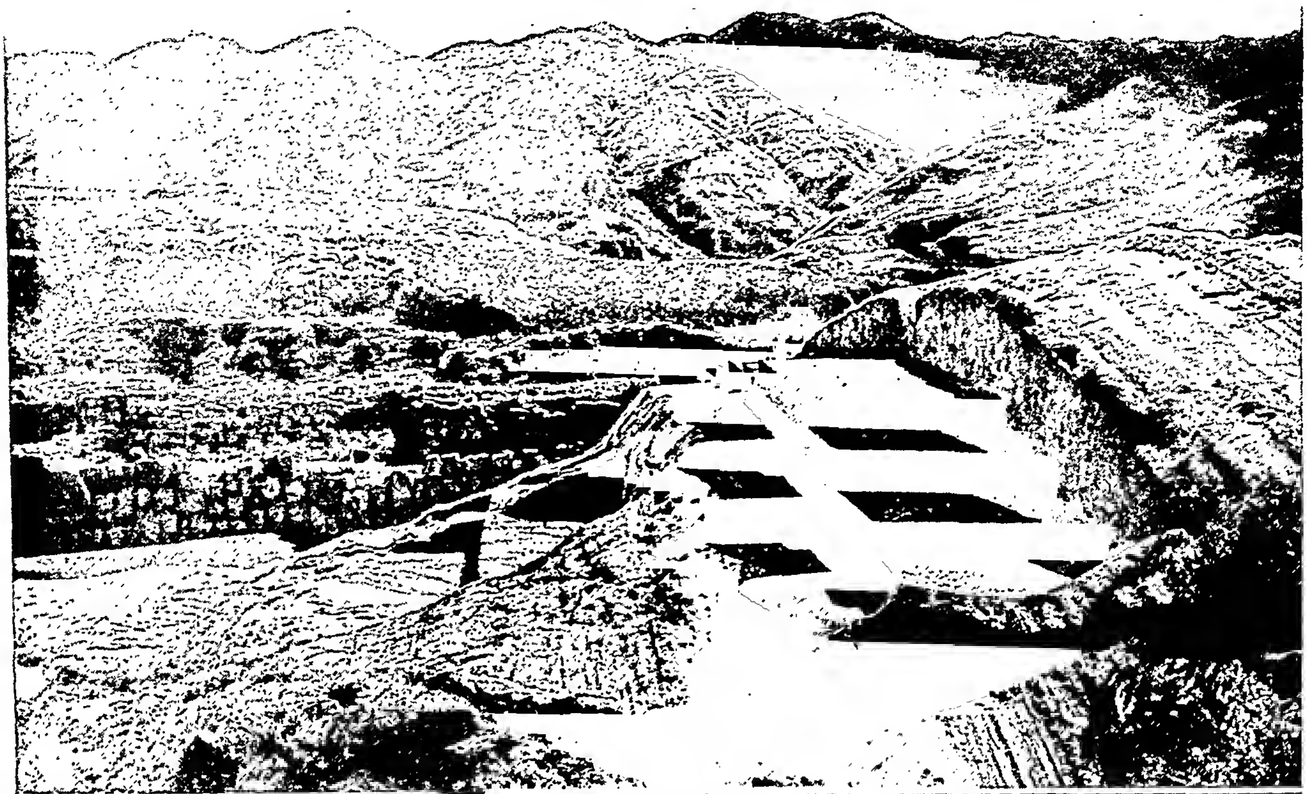
By the time the Spaniards arrived, however, the empire had been weakened by civil war. Its fall to Pizarro and his handful of men is one of the tragedies of history (*see* Pizarro). After a few disastrous rebellions, the spirit of the people was broken, and they declined into the submissive apathy which marks the Peruvian Indians of today. Cruelty and oppression continued through centuries until the pureblood descendants of the people of the Inca tribes are now estimated to be fewer than 3 million. The ancient population is said to have been between 8 and 10 million. (*See* Peru.)

IN THE ANCIENT CAPITAL OF THE INCAS



The walls of many of the houses in Cuzco, Peru, capital of the ancient empire of the Incas, are extensions of the remains of the old Inca walls. The stones in the lower half of the buildings in this picture were set by Inca masons, perhaps before Columbus discovered America. The strength of these massive walls testifies to the high skill of the old Indian architects.

INCOME TAX. As a means of defraying the increasing expenses of government, taxes on income have become an important part of the fiscal system of practically every modern nation. The rate of taxation is usually graduated according to the income of the individual or corporation, and incomes below a certain amount are exempt. The income tax became a part of the British fiscal system in 1853. In the United States this direct tax was not adopted until 1913, when the 16th amendment to the Constitution was passed, permitting a tax on incomes. (*See* Taxation.)



The engineering skill and organizing ability of the early Indians of Peru were remarkable. At the top is the "Inca Throne," actually a grandstand overlooking the plaza of Fort Sacsahuaman, where games were probably played. This is one of the world's greatest forts. Its stones are 30 feet high, and some of them weigh more than a hundred tons. At the bottom is a diorama in the Chicago Natural History Museum of an Andean valley at the time of the Incas. It shows the typical terraced farms, irrigation system, and a suspension bridge at the lower left. In the background on the mountain side is a stone fort.

The REPUBLIC *of* INDIA *and Its Age-Old* PROBLEMS

Village schools are the hope of the new India. Educated citizens are needed if the republic is to survive and solve its problems. Here the children are studying a giant mosquito as part of the campaign to stamp out malaria.

INDIA. When India won its freedom in 1947, the young nation had many advantages and many problems. It had a vast, fertile, and often beautiful land; about a sixth of the world's population; and a proud, ancient civilization. Hunger, disease, and ignorance, however, were the lot of the mass of its people. Their leaders knew that many time-worn customs had to give way to 20th-century methods before the new republic could prosper and grow great.

The republic of India shares with Pakistan a peninsula of southern Asia so vast that it is often called a subcontinent. The two nations were founded when Great Britain gave up its Indian Empire. Pakistan is formed from sections in the northeast and northwest where the people are predominantly of the Moslem, or Mohammedan, faith (*see* Pakistan). The larger part of the territory, 1,176,860 square miles in which the Hindu religion prevails, fell to India. When its new constitution went into effect on Jan. 26, 1950, it became the Republic of India, or, in the language of the country itself, Bharat.

The peninsula is like a great triangle slicing into the Indian Ocean and dividing the waters into the Arabian Sea on the west and the Bay of Bengal on the east. The snow-clad Himalayas tower along the north border. Here India's neighbors are Tibet, Nepal, Sikkim, and Bhutan. Pakistan borders it on the northwest, Burma on the northeast. At India's tip, the island country of Ceylon lies to the southeast across Palk Strait and the Gulf of Mannar.

India's Natural Regions

The map of India shows three separate and well-defined regions. They are the Himalayan ranges and their foothills; the broad, fertile river plains; and the tableland, or plateau, in the peninsula proper.

The highest range of the Himalayas rises to a mean elevation of 20,000 feet (*see* Himalayas). The lower slopes and hills are mainly in forest or grazing land. Among them lie lovely, rich valleys with fields of grain and vegetables and orchards bearing apples, pears, and other middle-latitude fruits. Tea is grown on the rain-swept eastern slopes.

The River Plains

The giant rivers that built the vast river plains have their source in the Himalayas' melting snows. For ages they carried down the silt that now lies hundreds—even thousands—of feet deep over their broad valleys. Since partition, the Indus and most of its tributaries flow through West Pakistan, and several of the channels that make up the delta of the Ganges and Brahmaputra run through East Pakistan.

India holds the level Ganges basin—some 1,500 miles long and from 200 to 400 miles wide. Here one of the world's most densely settled farming populations tills the thick alluvial soil. About 70 per cent of the land is cultivated, and two crops a year are raised in many places. Rice is the chief crop in the moist eastern end of the valley. Wheat, cotton, sugar cane, and grain sorghums are leading crops in the west.

The snow-fed rivers of the plain are excellent sources of irrigation water that does not fail in the

Extent.—North to south, 1,750 miles; east to west, 1,650 miles. Area (1951 census, omitting disputed regions), 1,176,860 square miles. Population (1951 census, omitting Kashmir and Jammu and tribal Assam), 356,829,485.
Natural Features.—Himalayas; river plains; Vindhya Range and Eastern and Western Ghats, enclosing the Deccan plateau; Thar Desert in Rajasthan. Principal rivers: Ganges and Brahmaputra.
Products.—Agricultural: rice, grain sorghums, wheat, millet, legumes, cotton, oil seeds, sugar cane, tea, coffee, rubber, spices, fruits. Mineral: coal, iron ore, mica, gold, manganese, salt, gems. Manufactures: textiles (cotton, jute, silk, wool, synthetic fibers), iron and steel, machinery, sugar, vegetable oils, paper, leather, shellac, cement.
Cities.—New Delhi (capital, 276,314); Bombay (2,839,270); Calcutta (2,548,677); Madras (1,416,056); Hyderabad (1,085,722); Delhi, Ahmedabad, Bangalore, Cawnpore, or Kanpur (over 700,000).

dry season. Ground water is also abundant, permitting irrigation from wells. India's portion of the Indus plain contains the eastern part of the Punjab and part of the Thar, or Great Indian, Desert.

The Brahmaputra Valley, about 50 miles wide and less than 500 miles long, cuts through the Indian state of Assam in the northeast. Here huge forests of teak and sal grow, and jungle marshes lie along the river. Rice is the chief valley crop, and tea is grown in the foothills. The Brahmaputra, called the Tsangpo in Tibet, rises behind the mountains a few miles from the source of the Indus. These rivers curve around in opposite directions and embrace the main Himalayan chain and that portion of northern India historically called Hindustan.

In the Deccan, or Peninsula Plateau

South of the great curve of the river plains rise a jumble of hills and mountains. The Vindhya Mountains are the principal range. They merge into the plateau, called the Deccan, that covers most of the peninsula proper. Its western edge is the Western Ghats (literally "steppingstones") that rise abruptly to an altitude of about 8,000 feet from a coastal lowland—the Malabar Coast. The plateau slopes gradually to the Eastern Ghats and the Coromandel Coast. Where the Ghats meet in the south the Nilgiri Hills rise. The Cardamon Hills form the Deccan's tip.

The leading rivers—the Godavari, Kistna, and Cauvery—flow from the Western Ghats across to the Bay of Bengal. Fed by seasonal rains, they bring destructive floods and later run dry. For centuries the people have impounded stream waters in reservoirs, or tanks, for irrigating. In recent decades huge installations have been built, including the giant Mettur Dam on the Cauvery in Madras. It stores water for more than a million acres and generates electric power.

Natural harbors are few. Cliffs, bare beaches, and mangrove swamps follow much of the eastern shore. Coconuts flourish along the coastal plains, and the West Coast has long been famous for its spices.

LOFTY HIMALAYAS ON INDIA'S NORTHERN BORDER

Here we look northwestward from the hill town of Darjeeling to snow-clad Mount Kanchenjunga, third highest peak in the world. It is outside India on the border of Nepal and Sikkim. Notice the terraced slope. Tea grown in these foothills is exported throughout the world.

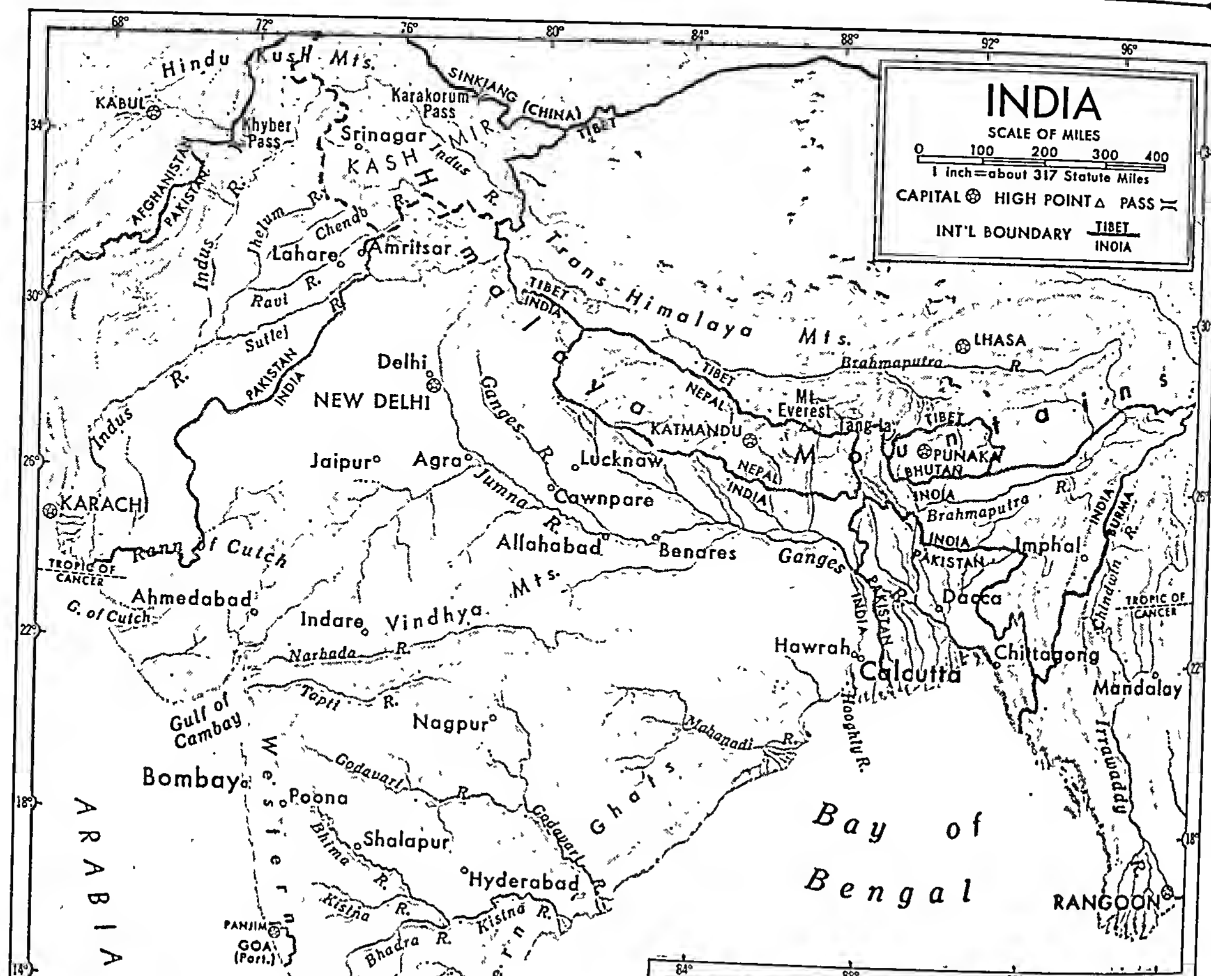
Scattered over the Deccan are steep, rugged areas still covered with primeval forests. Primitive hill tribes in the forests of the northern uplands have little contact with their civilized neighbors. They live by hunting, fishing, gathering wild seeds and berries, and tilling small burned-over garden spots.

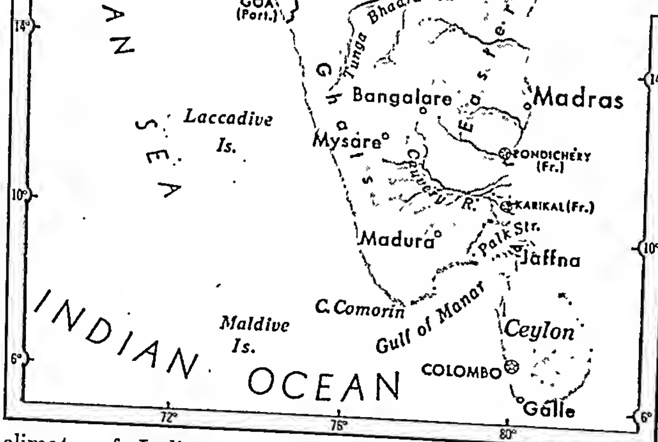
The eastern and southern uplands contain India's richest stores of minerals. Here are coal, high-grade iron ore, limestone for making steel, and abundant manganese and mica. Gold is mined in Mysore.

The Deccan is cultivated where the land is level and fertile enough and where rainfall is sufficient or irrigation water is available. Cotton is the leading crop in a large area of black, volcanic soil in the western part of the Deccan. Other cash crops are peanuts, sugar cane, and tobacco. Millets and legumes are raised for food. Tea grows in the south.

Monsoons Govern Climate

India's range of latitude is wide. Its northern boundary is about as far north as the Carolinas, while its southern boundary is as far south as Venezuela. The





This map shows the four great physical divisions of the Indian peninsula. Across the north, tower the Himalayas, highest in the world. Below lies a fertile river plain, stretching from the highlands of western Pakistan to the slopes of the Burmese ranges on the east. To the south, the land rises to form the vast tableland known as the Deccan. From the Deccan the Ghats slope down to the east and west coasts.

climate of India, however, tends to be tropical throughout because the Himalayas bar the winter winds that would bring cold from the heart of Asia. South of the mountains, the river plains get light frost, but elsewhere the weather is warm or hot the year round. Since temperatures vary little, differences in crops and natural vegetation are largely due to differences in rainfall and soil.

Climate, rainfall, agriculture—the very existence of the people—are dependent upon seasonal winds called *monsoons* (*see* Winds). The great, or southwest, monsoon comes in June when the land is baked by the high sun. The wind sweeps in from the Indian Ocean laden with moisture. Within a week the life-giving rains have turned the parched land into a mass of green. The summer monsoon blows until late September or October, bringing 85 to 90 per cent of India's rain.

The heaviest rains fall where the winds are suddenly cooled as they are forced upward over mountains. The Malabar Coast receives some 200 inches a year where the winds strike the steep Western Ghats. North of the Bay of Bengal, outlying ranges of the Himalayas cause downpours amounting to an annual average of more than 400 inches at Cherrapunji, the wettest place in India.

The mountains turn the wind and funnel it up the Ganges Valley, where rainfall decreases from 60 to 80 inches annually at the delta to about 25 at Delhi. In most of the Punjab and all the Thar Desert, rainfall is too scanty for farming without irrigation.

The plateau is also fairly dry, since winds blowing from the southwest have lost most of their water

while rising above the Ghats. Rainfall averages from 20 to 40 inches a year and irrigation is needed in many areas. Evaporation is so great that at least 30 inches are usually needed to support crops.

The northeast monsoon comes in November and December. Its force is but half that of the summer monsoon. For the most part it blows overland and carries little moisture. The eastern and southeastern coasts get abundant rain borne in from the Bay of Bengal.

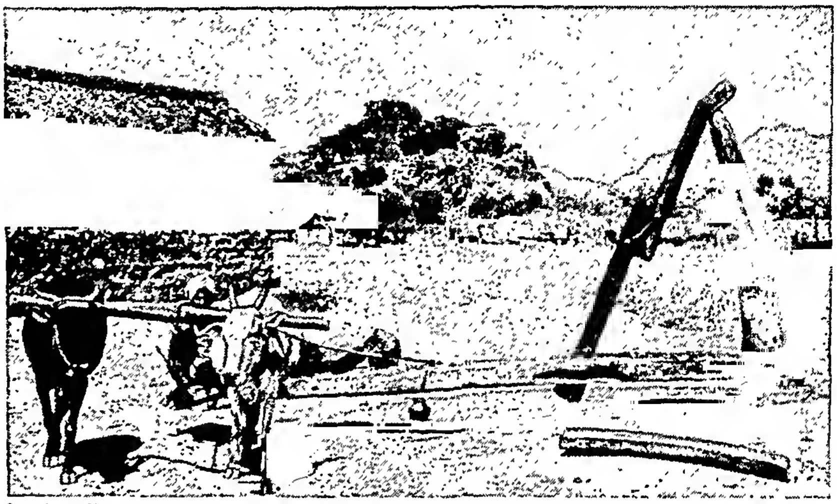
November to February is the cool season. The clear, brisk air is stimulating to Europeans, but the lightly clad Indians find it cold. March brings the hot season, with daytime temperatures of 100° F. and more. Weeks of clear skies and hot sun evaporate the soil's moisture, parch the vegetation, and exhaust the people. Everything awaits the coming of the great monsoon.

Flowering Plants and Spreading Forests

Over India's vast and varied land grows a rich and diversified vegetation. Some 15,000 flowering plants have been listed, together with innumerable shrubs, trees, and vines. The Himalayas at various altitudes bear trees of many climates, ranging upward from dense tropical rain forests through oak, maple, pine, and fir to rhododendron, stunted larch, and birch. Above the timber line mountain meadows lie beneath bare rock and snow-clad peaks.

ON THE LOW RIVER PLAIN AND THE ROCKY PLATEAU

The broad, level Ganges plain is one of the world's great, fertile farming regions. When the monsoons bring abundant rain, the land will yield two or more crops a year. Here village women are gathering sweet potatoes, planted as a dry-season crop.



Rocky hills, eroded land, and seasonal floods keep the Deccan from being a superior farming region, but most of the people make a living from the soil. Here oxen plod in a weary circle turning a crude mill to press oil from peanuts, a leading crop.

Little remains of the natural growth in the closely cultivated Ganges plain. Large areas of the Deccan forests have been cleared for farming or burned to encourage the growth of grass for pasture. When farmland is abandoned, it is quickly overgrown with bamboo thickets and jungle. Trees in the natural forests vary with the amount of moisture available. They range from mangrove swamps on the coast through wet and dry tropical and subtropical forests to thorn forests of acacia, mimosa, and euphorbia on the drier Deccan and the borders of the Thar Desert. Teak and sal are valuable timber trees of the monsoon forests. Lac, used in shellac, is another valuable forest product. It is secreted by the lac insect which feeds on sal foliage. Sandalwood groves are cultivated.

Wild Animals in the Jungles

India's vast forests; swamps, and jungles shelter a wide variety of wild animals. Tigers are especially feared by Indian villagers. The animals prey upon their livestock, and older tigers may become man-killers. The leopard is found in all parts of India. The cheetah is sometimes trained to hunt antelope in the Deccan. The Kathiawar peninsula contains perhaps the last wild lions in Asia. The Himalayan sun bear roams the mountains, and the common black bear makes its home there and in other hilly areas. Wolves menace sheep raisers on the plateau and drier parts of the plain. Other beasts of prey include the jackal, the wild dog, or *dhole*, and the striped hyena.

Wild elephants, caught in southern jungles and in the Assam rain forest, are tamed for work. Rhinoceroses roam in the Assam forests. Among the grazing animals are antelopes, *gaurs* (wild cattle), wild goats, and numerous species of deer.

Animal pests destroy thousands of tons of crops each year. Monkeys, wild pigs, deer, and such rodents as the bandicoot rob the fields, and rats do an estimated one million dollars' worth of damage to stored food. Swarms of insect pests injure people and crops. The mosquitoes that breed in ill-drained places bring a dreadful toll of malaria. A million or more die from the disease each year, and millions of others are so

MODERN OCCUPATIONS AND AGE-OLD CALLINGS IN INDIA

At the left a Delhi medical technician in a spotless white sari gives an injection to an employee under an insurance plan. At the right, two Sikh fruit sellers squat in the market place. Their forefathers probably followed the same occupation. The fair skins and sharp features of these four people indicate that they are of the Aryan stock, predominant in the north.

weakened by recurring attacks that they cannot do their work well.

Reptiles are numerous. Crocodiles swim in the rivers, and snakes slither from woods and gardens into village houses. The hooded cobra, the krait, and Russell's viper are the most dangerous of the land snakes. Salt-water snakes are also poisonous.

The most colorful birds are the parrots. The peacock, sacred to the Hindus, flaunts its gorgeous plumage both as a wild and as a domestic fowl. Eagles, vultures, hawks, and water fowl are abundant.

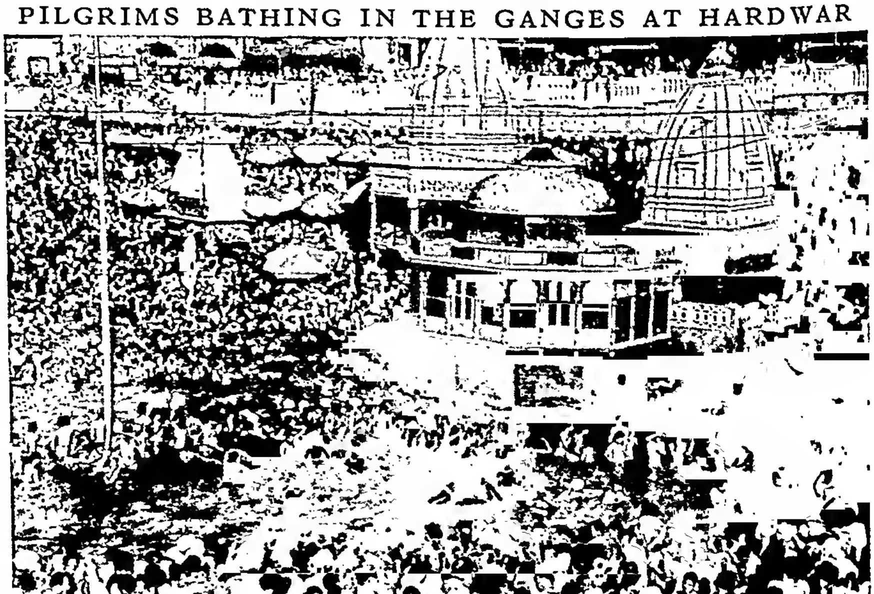
The Varied Peoples and Their Languages

In a land less than half the size of the United States, the Republic of India had 356,829,485 people at the 1951 census. (This omits the population in Kashmir and Jammu, claimed by both India and Pakistan, and the parts of Assam inhabited by primitive hill tribes.) India has an average of about 300 persons to the square mile, as compared with 50.7 in the United States. This is a high population density for a land where three quarters of the people make a living by farming; yet in the lower Ganges Valley as many as 600 to 700 people cluster in a square mile, while only a few live in the desert and mountain areas.

The ever-increasing population has difficulty earning a living or even raising enough food on the limited land that can be farmed. A government study in 1950 found that in a typical farming village of Madras a family of five will earn the equivalent of only $67.83 a year. The life expectancy of a child born in India is slightly over 30 years, compared with about 68 years in the United States. Poor sanitation and medical care and an inadequate diet contribute to the high death rate.

The enormous variety of peoples and languages found in India arises from invasions that repeatedly swept over this fertile region in prehistoric ages as well as in historic times. Illustrations in this article show the varied stocks. The peoples may be roughly divided into five groups: (1) the descendants of the earliest known inhabitants of India, sometimes called Dravidians, who are represented by the primitive Bhils and Gonds of the central and western hill

PILGRIMS BATHING IN THE GANGES AT HARDWAR



Hindus believe Mother Ganges is especially sacred at Hardwar, where the river emerges from the foothills. They come to its bathing ghats by the hundreds of thousands. Here we see them washing in the purifying waters. They may carry a vial of the holy fluid back home.

VARIED AND MIXED PEOPLES OF THE HUGE POPULATION



The peasant girl at the left is picking cotton on the western Deccan. The young sculptor, at center, is cutting an intricate design in a temple pillar. At the right is a Darjeeling market woman. Her full, slanting eyes show descent from the Mongoloid immigrants. The dark skin, wavy hair, and blunt features of the first two people suggest that they are of Dravidian stock.

forests and by the Tamils of the south; (2) the pure-blood descendants of the successive tides of Aryan invaders who came through the northwestern passes and conquered the Dravidian inhabitants and who are best represented by the Rajputs; (3) the great mass of Hindus formed by a mixture of the two preceding types; (4) the descendants of the Mohammedan invaders who began pouring in during the 7th century; (5) the Mongoloid or Tibetan peoples, found chiefly in the extreme northeast and in the Himalayan border regions.

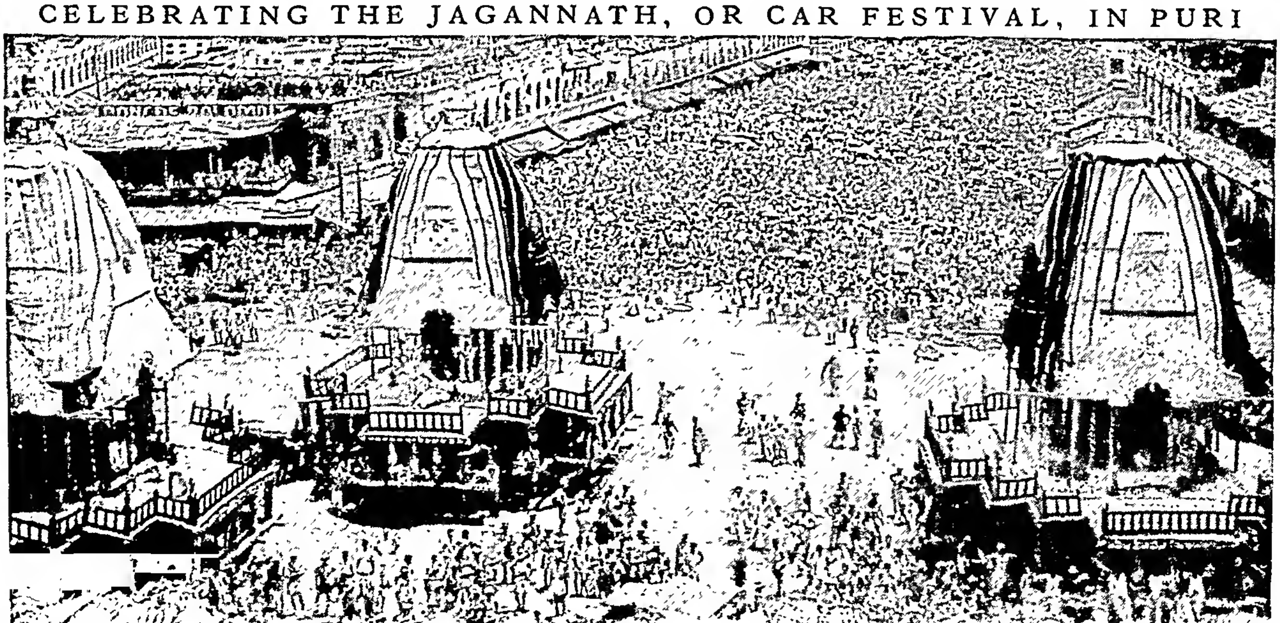
The people of Dravidian stock are short and dark, with curly or wavy hair and broad noses. The Rajputs are tall, slender, and lighter in skin color. Most Indians have some of the features of each type.

India has many languages. A survey listed 179 languages and 544 dialects. Only 14 are of major importance. The Dravidian languages of the south and the Munda dialects of the northeast stem from the original languages of the area. The Indo-European tongues of the north are derived from the languages of the invading Aryans and are related to Sanskrit. Of this group, Hindustani, which has two forms, Hindi and Urdu, is the most widely spoken. The official language is Hindi. English, spoken by educated people of all sections, may be used for official purposes for the first 15 years of the republic.

Myriad Religious Faiths and Sects

Religions have divided the people even more than language and physical differences. The chief religions

CELEBRATING THE JAGANNATH, OR CAR FESTIVAL, IN PURI



Here we see part of the immense throng of Hindus who come to Puri, on the Bay of Bengal, toward the end of June. The three huge, wheeled platforms carry images of the god Krishna, his brother, and his sister. The people drag them more than a mile from one temple to another. They feel that it is a great blessing and honor to pull the ropes.

are the Hindu, Mohammedan, Christian, Sikh, Jain Buddhist, and Parsee.

Hinduism is the oldest religion, excepting the primitive nature worship of the hill people. It includes in its numerous sects about 85 per cent of the people. Hinduism has many forms. All are marked by a belief in many gods and in many aspects or forms of each god (*see* Hinduism). Hindus believe that at death the soul passes into another body, either human or animal. Because of this belief Hindus avoid killing any living creature. Cows are held in particular reverence and it is a sin to kill them. This belief deprives the people of the nourishment of meat in the diet, and in many places permits destructive insects and animals to flourish.

The Sikh religion—an offshoot from Hinduism—was founded about A.D. 1500 as a reform movement. Its members centered in the Punjab, where they constituted a military brotherhood of formidable power. Today they comprise only 1.74 per cent of the population. The Jains tend to combine Buddhist and Hindu beliefs. Among them are many of the richest Indian merchants, though they make up only .45 per cent of the population. Their temples are especially elaborate. Those on Mount Abu, a place of pilgrimage in southern Rajasthan, are widely admired for their delicate carving.

The Parsees are descendants of Persian Zoroastrians—fire and sun worshipers who fled to India to escape the Mohammedan massacres of the 7th and 8th centuries. Centering about Bombay, they now form a rich merchant and industrial class of great power, despite the fact that they are but .03 per cent of the population.

Christians compose 1.3 per cent, with Roman Catholics the largest group. The Moslems, or Mohammedans, account for 10 per cent, though the great mass of the Moslems of the peninsula live in Pakistan. The Buddhists, once a large and powerful sect, now make up only .06 per cent of the Indians (*see* Buddha).

The Caste System

The Hindus are grouped into countless castes, which are partly social and economic and partly religious. The caste system had its foundation in the old Aryan law, which divided the people into four classes—the priests, or Brahmans; the warriors, or Kshatriyas; the farmers, or Vaisyas; and the laborers, or Sudras. The first three are regarded as the "twice born." The last consisted of the conquered non-Aryan peoples.

Today the four original castes have been subdivided until it is impossible to tell their number. Estimates vary between 2,000 and 3,000 distinct groups. The divisions grew up on a basis of race, geographical situation, and occupation. The members of each handicraft, such as potters and jewelers, form separate castes, which amount to trade guilds or unions.

The many restrictions which in the past surrounded members of a caste have been relaxed, especially in the cities. Generally speaking, a person might not marry outside his caste, nor might he touch or associate with a member of a lower caste. There were only certain castes from whom he could accept food or water. Once some of the high-caste Hindus felt that they were profaned if even the shadow of a European or a member of a lower caste fell upon them.

Lower than the Sudras are the outcastes and other "depressed classes"—some 60 million people. Most of these were regarded as "untouchables" and were barred from using the public roads, bridges, and temples. They lived outside the villages and engaged in such despised and ritually unclean occupations as tanning and scavenging. The Indian constitution now forbids the practice of untouchability, and various states have passed laws providing equal rights for these "scheduled classes." Old beliefs and prejudices make the enforcement of these laws difficult.

How the People Live

Nine tenths of India's millions live in villages scattered amid the fields. Many of these settlements are not even on a highway, but are reached by a path or rutted cart road through the farmland. Here houses for 100 to 500 families cluster tightly together along narrow, twisting alleys. Occasional open spaces afford room for a Hindu temple, a Moslem mosque, a well, or a threshing floor. Beyond the houses a "tank," or shallow pond, is used for washing clothes and vegetables, for watering stock, and even for refuse. Sewer systems or other means of waste disposal are lacking.

House walls are mostly built from layer after layer of mud, rising to thatched roofs. In the south, straw matting or loosely woven bamboo makes walls and partitions that let in the breezes. A few stone or brick houses shelter the wealthier moneylenders, landlords, and shopkeepers.

The families in the mud houses are seldom composed only of mother, father, and young children. The "joint family" is more customary. Sons bring their wives to the family home and rear their children there. The wives work under the direction of their mothers-in-law. The father heads the household and uses the joint earnings of the family for the support of all its members.

Preparing and Serving Food

The women keep busy with cooking and housework. Their methods have changed but little through the centuries. They usually cook in the courtyard, where they build a fire under a sheet of iron resting on clay supports. The main meal—perhaps the only meal—comes at noon. It may consist of a gruel of parched gram or other lentils, eaten with pancakes of unleavened bread, called *chappatis*. On special occasions vegetables and such cereals as grain sorghums, seasoned with curry mixtures, may be served. In some sections, there may be rice or fish. Meat is seldom, if ever, eaten for religious and economic reasons.

The women serve the food on brass trays set on the floor. The men squat about it, taking the food in the right hand. The women and girls dine only after the male members of the family have finished.

Working in the Fields

Early in the morning the peasant, or *ryot*, and his sons go to the field and hitch the oxen to a light

LIFE AND WORK IN AN INDIAN VILLAGE

Mud-brick, thatched houses crowd together along this village lane. The women at the right are pounding rice in a wooden mortar. To their left, rear, a woman is spinning on a wooden wheel, called a charka. The two men farther down the lane have come in from the fields carrying a mattock and a plow. Notice the draping of the men's dhotis and the women's saris.

wooden plow with an iron point. It stirs the soil but does not turn it. If the ground has been baked hard by drought, they may have to wait until the monsoon rains soften it. At harvest time, they cut the grain with a sickle—a handful of stalks at a time. They carry the grain to the threshing floor where it is trampled and broken from the husk by cattle. Girls toss the grain in the wind to blow the husks away.

The farm may amount to no more than three to five acres. It is usually cut into widely separate strips. The land has been divided in this way as generation after generation of sons have inherited shares of a farm. A farmer may own a field beside a stream that can be flooded to grow rice, a drier field for grain sorghum or cotton, and rocky or worn-out pasture.

Even though they grow a summer and a winter crop on the same strip, they seldom get as good a yield as farmers elsewhere. All but the deepest soils have been worn out through centuries of tilling. The cattle manure that should fertilize the land is dried and burned for fuel because firewood is scarce. The ryot is too poor to buy fertilizer or high-grade seed.

If the monsoon rains are light, the crop may fail entirely. Then the farmer must go to the moneylender, called the *bania*. Interest rates are so high that the ryot may never get out of debt. If he is unable to pay, the bania may take over the land.

Children in a Joint Family

Children in the big households have plenty of playmates and numerous elders to give them care and attention. Boys are preferred to girls because each man wants a son to carry out the funeral and memorial rites after his death, and he must supply daughters with a dowry he can ill afford.

Peasant children begin helping with household tasks at eight or ten years of age. The boys take the cattle to pasture or help in the fields. The girls learn to grind grain in the crude stone *chucki*, to mix and pound spices for curry, and to carry water from the well. In India today they may attend primary school.

Young people marry early in India. Marriage of boys under 18 years of age and girls under 14 is forbidden by law. High-caste Brahmans may ignore the law because they believe a girl should marry at puberty. Usually the child bride remains with her family until she is 15 or 16. Marriage celebrations are elaborate. Relatives come from near and far for the feasting. The minstrel, or piper, entertains the crowd. The expense of the affair and of the bride's dowry frequently drives the father to the moneylender.

When a husband dies, the widow is not permitted to remarry. She remains in the husband's home to work at disagreeable chores. Before the practice of *suttee* was made illegal, a widow might throw herself in the flames of her dead husband's funeral pyre.

The peasants have few amusements other than weddings, caste celebrations, and religious festivals. The women find time for a little gossip at the well or the grain-grinding shed. In the evening the men gather to smoke and talk. Perhaps the schoolmaster will read the newspaper aloud or a bus passenger will tell of his trip. Wrestling matches and cockfights offer occa-

sional entertainment. A traveling movie show or troop of actors may give a performance for those who can pay. In recent years loud-speakers have been installed in some villages to bring music, political speeches, and news of the distant world. Peasants rarely go farther from home than a market in a nearby town. A few make a pilgrimage to one of the holy cities of Hinduism, such as Hardwar and Benares on the Ganges.

How the City People Live

The cities afford violent contrasts. Here are elaborate temples and mosques, the palaces of princes and other wealthy people, and tree-set boulevards lined with handsome stores and offices and the comfortable apartments of the well to do. Not far away stand squalid slums where two or three poor families huddle in a single room. Narrow bazaar streets twist through the heart of the city. Cars and trucks thread their way through throngs of people, carts, and animals, avoiding the sacred cows that wander along. Sidewalk merchants call their wares, beggars whine for coins, and ragged children play underfoot. At night the sleeping forms of the homeless stir in the corners.

Most city workmen are hand artisans, unskilled laborers, and domestic servants. There are not enough manufacturing plants to hire large numbers. The cities have an educated middle class unknown in the villages. They receive their schooling in the universities and work in the professions or in government and business offices. They took the leading part in the movement for Indian independence and have played an influential role in the establishment of the republic.

Many educated women have broken with the age-old customs restricting Hindu women. They are found in the professions and in the arts and hold important posts in the government. They have sponsored political, public-health, and social-welfare movements to improve the condition of women and children.

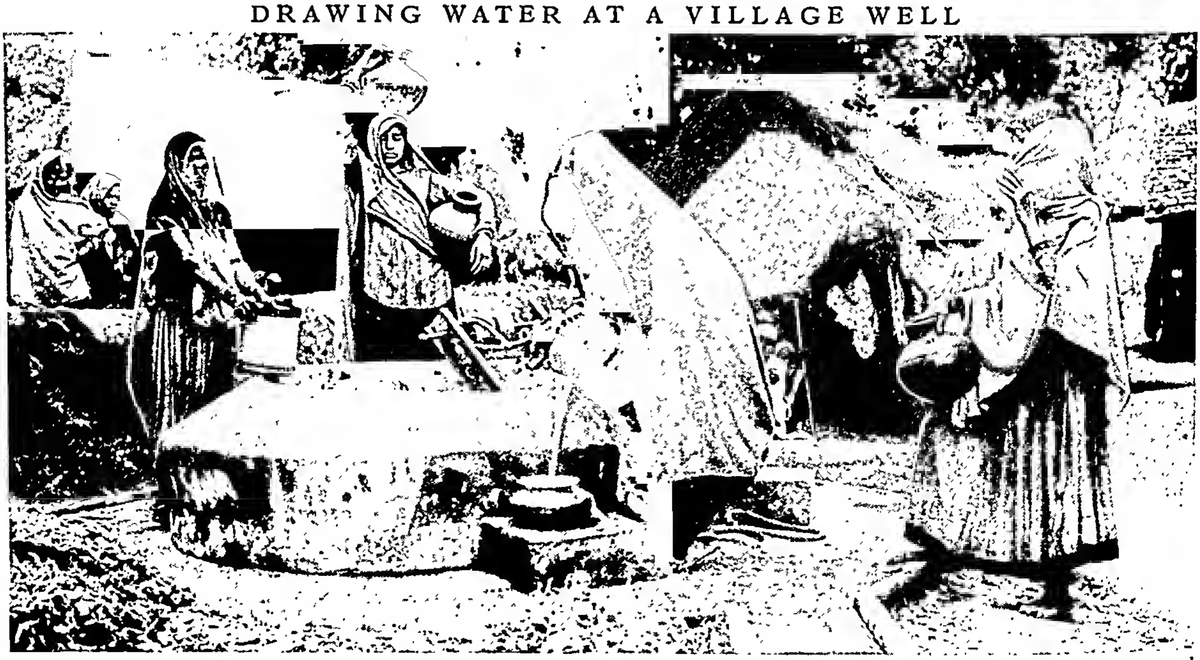
PREPARING DINNER IN A COURTYARD

The woman at the right is stirring the dough for chappatis, while a pot of gruel steams over a fire in the corner. Her costume, consisting of a loose shirt, pajamas, and scarf, indicates that she lives in the Punjab.

Clothing in India

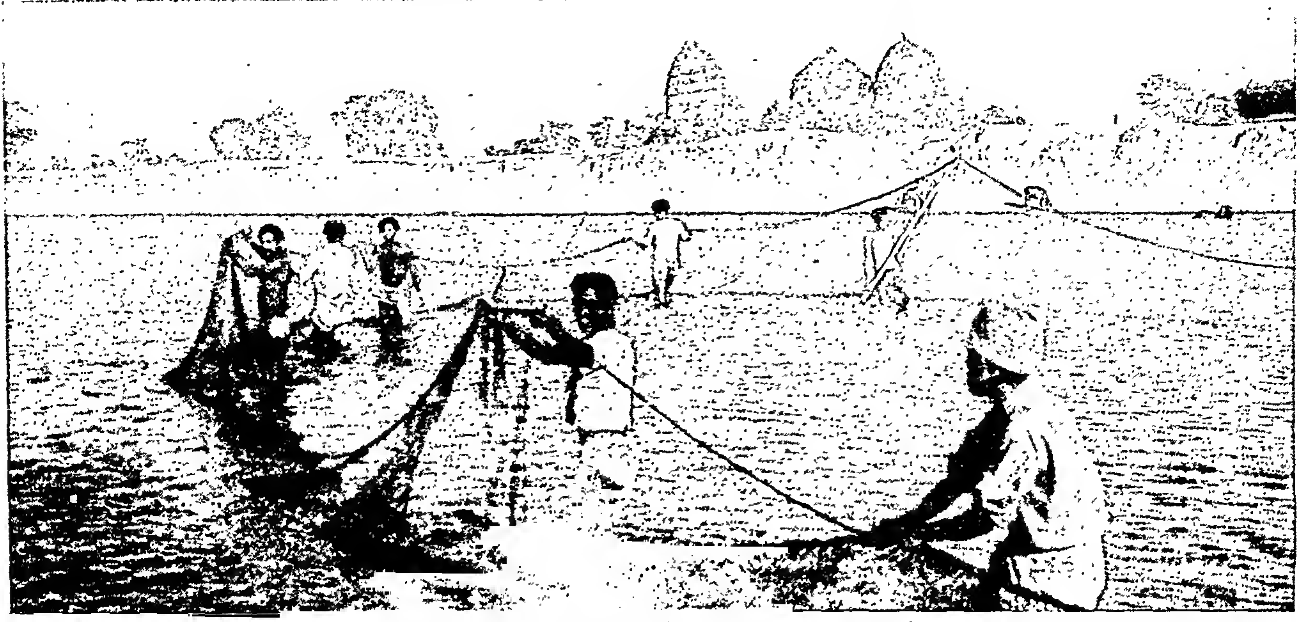
Many kinds of clothing are seen on the city streets. Many city men have adopted Western attire, but most women cling to the graceful *sari*. The garment is draped from a strip of cloth five to nine yards in length. The well to do may wear exquisite sheer fabrics bordered in gold and silver thread. Even the coarse cotton of the peasant woman is becoming and graceful. One end is tucked into the petticoat waist-

DRAWING WATER AT A VILLAGE WELL



Villages of a hundred families may have but one well. When the women come to draw water, they exchange news and gossip while they wait their turn. The full skirts, long shirts, and scarves of the women are costumes worn in north-central India.

FISHING IN A VILLAGE TANK



This village tank has been stocked with fish and the men are seining them. It is a shallow pond dug to hold rain water. Deeper tanks made by damming a stream can be used for irrigation. Notice the cattle drinking and the tall strawstacks.

band, then the sari is wrapped around the hips with soft pleats in the front. The other end of the cloth falls over the shoulder or is thrown over the head. A bodice, called a *choli*, may be worn underneath.

Orthodox Moslem women cover themselves with a tentlike garment, called a *burka*. It has a crocheted "window" over the eyes. Girls and women like to deck themselves with bracelets, anklets, and other jewelry. A family's wealth may be in the women's silver bangles. A dot of red powder, or a tiny disk of colored metal, called a *kumkum*, decorates a girl's forehead.

The garment customarily worn by men is the *dhoti*, a strip of white cloth wrapped around the hips, drawn between the legs, and tucked in the waistband at the back. In the north, both Hindus and Moslems may wear a loose pajamalike garment, the *salvar*, with a flowing shirt, known as the *kurta*. The *churidar*, favored in Kashmir and in Rajasthan, fits tightly below the knees, not unlike jodhpurs. On ceremonial occasions, a long coat, called the *sherwani*, is worn with the churidar. The finest are made of rich satin or brocade and trimmed in jeweled buttons. Various styles

WORKERS IN THE FIELDS AND IN THE CITY

This small pedal-operated rice thresher is a crude device compared to American power threshing machines, but it represents an advance over the method of trampling out the grain with the feet of oxen. On a Bombay street, roaming sacred cows share the sidewalk with two basket porters waiting to be hired. Notice that the business signs are in both English and Hindi.

PROJECTS TO INCREASE INDIA'S FOOD SUPPLY

The tractor and huge plows and harrows above are tearing up long roots of an Indian weed, kans grass. This weed had ruined millions of acres of land and could not be uprooted by ordinary plows. A loan from the World Bank financed the purchase of machines to reclaim this land, as well as swamps and jungles.

The Food and Agriculture Organization of the United Nations is conducting experiments to increase India's rice crop. They are creating new hybrid varieties that yield more grain than the type raised by Indian farmers. The agriculture student above is examining the pollen and growth of a hybrid plant.

of turbans are worn in different sections of the country. A boat-shaped white cap, called the Gandhi cap, is the emblem of Congress party members.

Agriculture—Leading Industry and Occupation

Agriculture is by far India's leading industry and the source of livelihood for about three quarters of its people. Rice occupies the largest acreage, and it is the favorite food. Wheat, three sorghums—jowar, bajra, and ragi—millets, barley, and corn are grains that grow in areas too dry for rice. Gram, or chickpea, beans, peas, and other legumes are raised in all sections, usually as a winter crop. They are a leading protein food taking the place of meat in the diet. The oil seeds and other oil-producing plants include peanuts, linseed, rape, mustard, sesamum, and castor beans. Cotton and sugar cane grow on millions of acres. Cotton is the chief cash crop since the great jute-growing area in east Bengal fell to Pakistan. India also produces tea, tobacco, coffee, coconuts, rubber, a wide variety of fruits, indigo, spices, and quinine.

More cattle are found in India than in any other part of the world—perhaps 135 million head. For the most part, however, they are poorer than the cattle of other countries. Since the Hindus prohibit the killing of cattle, feeble and diseased animals wander about eating the fodder needed by better stock. The average cow gives only two to four pints of milk a day. Cattle are used chiefly as work animals. Indians also raise considerable numbers of water buffaloes, sheep, goats, hogs, and poultry. Hides and skins are exported.

Programs for Improving the Crop Yield

Although India's vast agricultural lands and millions of farmers produce an immense total crop, they cannot feed the huge and growing population. Grains must be imported even in good years. When the monsoon rains are light and crops fail, millions of people suffer or die from famine. In the republic's five-year plan set up in 1951, half the program dealt with the improvement of agriculture. The nation, aided by the United States, agencies of the United Nations, and other international organizations, provided huge sums for this work.

Long-range irrigation projects were allocated some 27 per cent of the outlay. Though India had 50 million acres under irrigation, it planned to add 8.5 million acres to increase hydroelectric power by more than a million kilowatts and to continue large-scale construction after the end of five years. Certain states also had large projects.

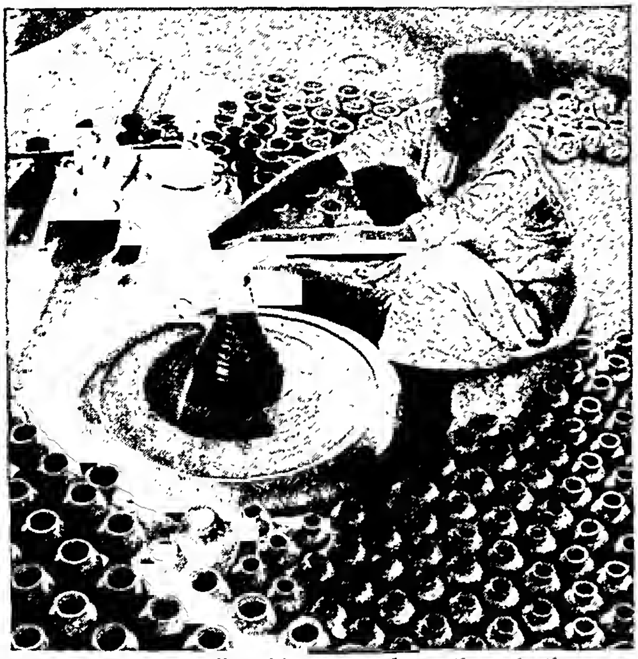
Irrigation and Community Projects

The program included multipurpose river projects for irrigation, flood control, power, and improved navigation. Loans from the International Bank for Reconstruction and Development aided the huge Damodar River valley scheme patterned after America's Tennessee Valley development. United States Point Four funds helped build the giant Hirakud Dam in the Mahanadi River. The Sutlej River in the northwest is being harnessed by the great Bhakra-Nangal project. American funds were set aside in 1952 to aid with building reservoirs and drilling 2,000 deep tube wells in the northern plains.

In some states more land is being provided for the individual farmer by breaking up great estates and paying the former owners. Co-operative credit associations lend money to farmers without ruinous interest rates. The government also encourages the growth of cottage and small-scale village industries to give villagers part-time work.

Community development projects, planned to reach some 13 million people in the villages, got under way

VILLAGE CRAFTS AND HEAVY INDUSTRY



Village craftsmen, like this potter, have through the ages turned out everyday wares for the people. Today many lack work because factory goods are replacing their products.

This blast furnace is part of the largest iron-and-steel plant in Asia—the giant Tata works at Jamshedpur, near Calcutta. We see molten iron flowing from the furnace into giant ladles on railway trucks. It will be poured into pig-iron molds.

in 1952. Supported jointly by American and Indian funds, trained workers lived as villagers, and they demonstrated that larger and better crops could be grown by using better seed, fertilizer, irrigation, tools, and farm methods. They showed how health could be improved by sanitary and other health measures.

Industries and Minerals

By Western standards, manufacturing in India is poorly developed, but it has the largest industrial organization in south Asia. Centuries ago, before the arrival of Europeans, India's textiles, gems and jewelry, carved ivory and wood, and fine copper and steel made by skilled hand craftsmen were famous in the Orient. Village artisans met the people's needs for tools, utensils, cloth, and the like. With British rule, trade with English manufacturers was encouraged. The Indians bought cheap foreign factory-made textiles, hoes, and other everyday items. They raised cotton, jute, and other commercial crops to provide raw materials for British mills.

The slow growth of manufacturing in India began in the latter half of the 19th century. Textile mills were the first built. The spinning and weaving of cotton and jute are still the leading manufactures. Other important industries include food, leather, iron-and-steel, machinery, paper, cement, chemicals, aluminum, and sugar.

Iron and steel production began in the early 20th century. The great Tata works at Jamshedpur is by far the largest producer. It is near rich iron ore, coal, and limestone deposits and convenient to the port of Calcutta. Steel-using plants in the vicinity turn the ingot steel into products ranging from wire and nails to agricultural implements, locomotives, railway rolling stock, ships, and armament.

The largest concentration of minerals is found in the highlands west of Calcutta, but deposits are scattered elsewhere. Iron ore in the Deccan tends to be undeveloped because coking coal is scarce. At Bhadravati, in Mysore, iron is smelted and steel is made, using hydroelectricity and charcoal.

India has abundant coal for any foreseeable need, but most of it is concentrated in the Chota Nagpur plateau of Bengal and Bihar. Large reserves of manganese are available, and three quarters of the world's sheet mica is supplied by India. Chromite, copper, bauxite, and salt are mined. The gold and precious gems for which India was long famed are still found, though in small quantities. The petroleum output is small.

Under the five-year plan, the government promoted industrial expansion. It offered inducements to foreign investors. In 1951 three foreign oil companies signed agreements to build refineries in India. Other new industries that opened as the plan got under way included factories to make dyes, fertilizers, drugs, chemicals, machine tools, telephone cables, and bicycles, as well as automobile assembly plants and shipyards. In some cases capital was furnished by both Indian and foreign investors. The government contributed funds to many ventures, and some plants

were wholly government owned. Foreign technicians trained Indians for skilled tasks and managerial posts.

Transportation, Communication, and Trade

Built by the British and mainly government owned, India's network of railway lines is the best in the Orient, amounting to some 34,000 miles. A variety of track gauges cut efficiency by requiring frequent transfers of freight. About one third of the country's more than 250,000 miles of public roads are hard surfaced. Seasonal river fluctuations hamper inland water transportation. Though coastal shipping in sailing *dhows* is large, it is handicapped by a shortage of harbors. Airlines link the principal cities and towns and connect them with the rest of the world.

Post offices, telephone, and telegraph systems are publicly owned. All-India Radio, government owned, controls radio broadcasting. Newspapers are privately owned. Most of the papers are printed in a regional language, but English-language newspapers have the largest circulation.

India's trade is immense. Though individual purchasing power is low, the huge population makes the total trade extremely valuable. Modern India is attempting to supply the needs of its own people and to sell goods to its south Asian neighbors.

Most of India's foreign trade is still with Great Britain and other members of the Commonwealth. Its trade with the United States has increased in recent decades. The chief exports are jute yarns and burlap, tea, cotton yarns and manufactures, spices, oil seeds and nuts, hides and skins, wool, manganese, mica, shellac, and cashew nuts. Its leading imports are machinery, grains, petroleum, vegetable oils, raw cotton and jute, vehicles, metals and metal manufactures, electrical goods, chemicals, drugs, dyes, and silk and synthetic yarns.

The Principal Cities

Bombay and Calcutta are by far the largest cities and greatest ports of India. They command the shipping lanes to the west and east, respectively. Most of India's important rail lines run from the productive interior to these ports, to Madras, the third port and city, or to Karachi—now in Pakistan. (*See also* Calcutta; Bombay; Madras.)

Calcutta's leading industry is jute manufacturing, but its varied factories include engineering workshops and metalworking plants. Bombay leads in cotton manufacturing. Ahmedabad and Poona are other busy cities of Bombay state.

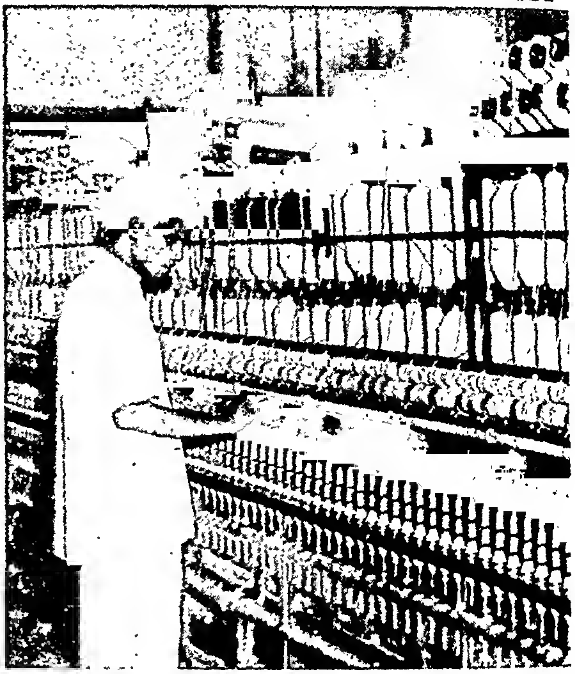
Hyderabad, the fourth city, is the capital of its state (*see* Hyderabad). Other South India cities include Bangalore, Madura, Mysore, and Trivandrum.

Cities along the Ganges flourished even in ancient times. They included such religious centers and places of pilgrimage as Benares, Allahabad, and Muttra. The cities that have grown large are railway and distributing centers, with some manufacturing. Among them are Lucknow, Delhi, Benares, Allahabad, Agra, Cawnpore, and the Sikh religious center Amritsar. New Delhi, the capital of India, was built to be the seat of government in British India (*see* Delhi).

Schooling for Young India

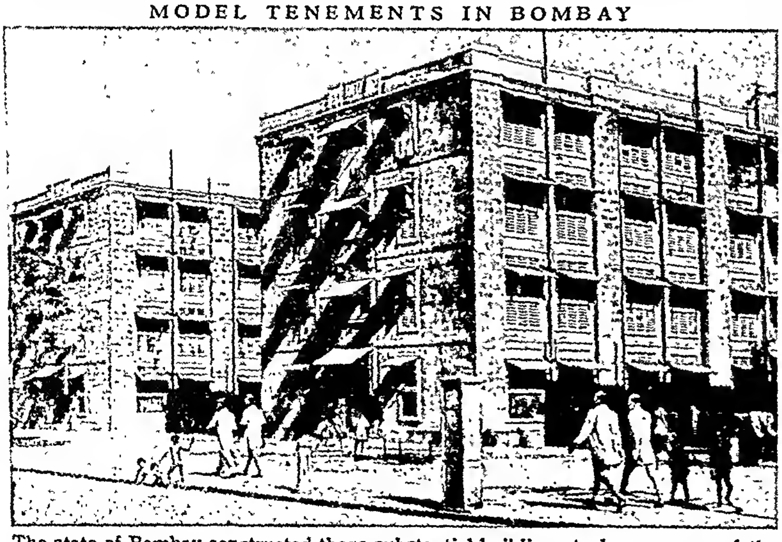
In this republic where more than 80 per cent of the people are illiterate, broadening of educational opportunities is one of the challenging problems. In 1947 the government

COTTON SPINNING IN A DELHI MILL



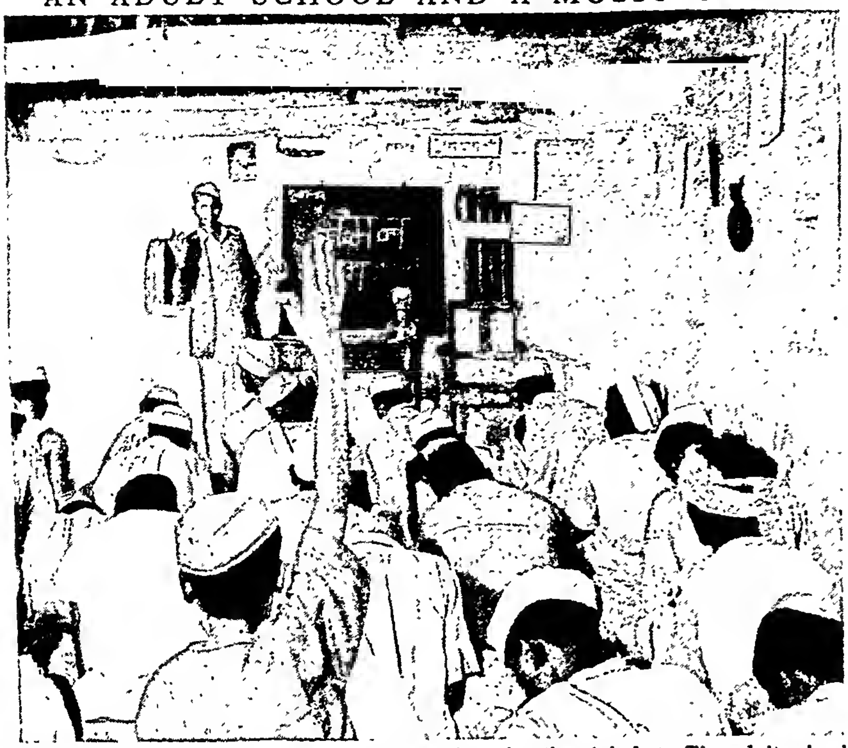
This textile-mill worker supervises the operation of a huge ring spinning frame, which twists thick strands of cotton fiber into thread. Textile making is India's leading industry.

MODEL TENEMENTS IN BOMBAY



The state of Bombay constructed these substantial buildings to house some of the new industrial workers who have poured into the city in recent years. Flimsy, crowded, ill-ventilated tenements, called chawls, are the lot of most city workers.

AN ADULT SCHOOL AND A MUSIC CLASS



After a day in the rice fields, these ryots are learning the alphabet. The adult school *is part of community projects designed to improve village farming methods, health,* and education. American funds and technical "know-how" aided them.

These young ladies in Lucknow are learning to play the sitar at a music academy. Indian performers sit on the floor when they play a stringed instrument.

sponsored a program designed to provide free compulsory education for boys and girls from 6 to 14 years of age and to abolish adult illiteracy. The states then began passing laws to carry out the program. Lack of funds and trained teachers made progress slow, but in 1950 there were more than 200,000 primary schools and one tenth as many middle and high schools. The mother tongue of the region is the usual language of instruction, but some high schools use English. The adult program is called "social education." Classes are offered in hygiene, home economics, agriculture, and cottage industries, as well as reading.

The first two modern universities were founded in 1857. By 1951, they numbered 29. Some are teaching universities; others are administrative institutions which prescribe courses of study for affiliated colleges. Instruction is usually in English, but the aim is to replace it with regional languages as texts are available. Professional and technical instruction is being increased to provide leadership in industry and public affairs.

Art—Ancient and Modern

Architecture is regarded as the chief art of India. It is distinguished by the same highly decorative style which gives unique beauty to Indian metalwork, jewelry, pottery, and textile patterns. Since early Hindu building was in wood and clay, remnants of ancient architecture are lacking. With the advent of Buddhism and Jainism came the construction of monasteries and shrines of stone. Many were cut from rock caves. The famous caves on the island of Elephanta in Bombay harbor are characteristic.

The great period of temple building by the Hindus began in the 6th century A.D. Temples of the north are characterized by tall spires, or *sikharas*. Those in the south are recognized by the broad gate towers, or *gopuras*, leading into the temple grounds. The temples are covered with mazes of carved figures in unbelievable profusion.

Moslem influences appeared from the 11th century onward. Mogul architecture, combining Persian and Moorish forms with Indian craftsmanship, produced elegant and graceful structures. The Taj Mahal, built by Shah Jehan, is the most widely admired of the many Mogul structures (*see* Taj Mahal). The Rajput rivals of the Moguls were also great builders. Characteristic are the island palaces of Lake Pichola in Udaipur.

Hindu painting and sculpture have been occupied with a religious imagery unfamiliar to the West. They have, therefore, appeared strange or even grotesque to Western eyes. Countless bronze and stone figures found in homes as well as in temples prove the skill of India's sculptors. In recent decades a minor movement in Indian painting has produced works showing a growing awareness of 20th-century Western art.

The work of Indian craftsmen has been famous for centuries. Their early skill in enameling with precious stones has long since died out. Enameled brasses are made in Jaipur, and damascened metal objects of gold and silver wire in Hyderabad and Kashmir.

Ancient Literature

The earliest Hindu literature consists of the Vedic hymns in the ancient Sanskrit language, of which the 'Rig-Veda' is the oldest collection. This consists of 1,017 short poems, mostly addressed to the gods. They give a definite picture of a high civilization existing about the time the Aryan invaders had reached the banks of the Indus and were fighting the "dark people" to the south. To the Vedic poems were attached prose works called 'Brahmanas', explaining the duties of the priests; then were added the 'Sutras', telling of laws and ceremonies; and later the 'Upanishads', treating of God and the soul; the 'Aranyakas', giving directions for leading a holy life; and finally the 'Puranas', or sacred traditions.

The two most famous historical poems are the 'Mahabharata', or chronicles of the Delhi kings, and the 'Ramayana', or story of the Aryan advance into southern India. The old Hindu fables of animals, translated into the Persian as early as the 6th century A.D., are said to be the basis for many of the nursery stories of England and America (*see* Storytelling).

THE GOD SIVA IN BRONZE

Sculptors often portray the principal Hindu god in this dancing posture. Poised on the dwarf of ignorance and ringed by a circle of flames, he symbolizes both creation and destruction.

Modern Literature and Music

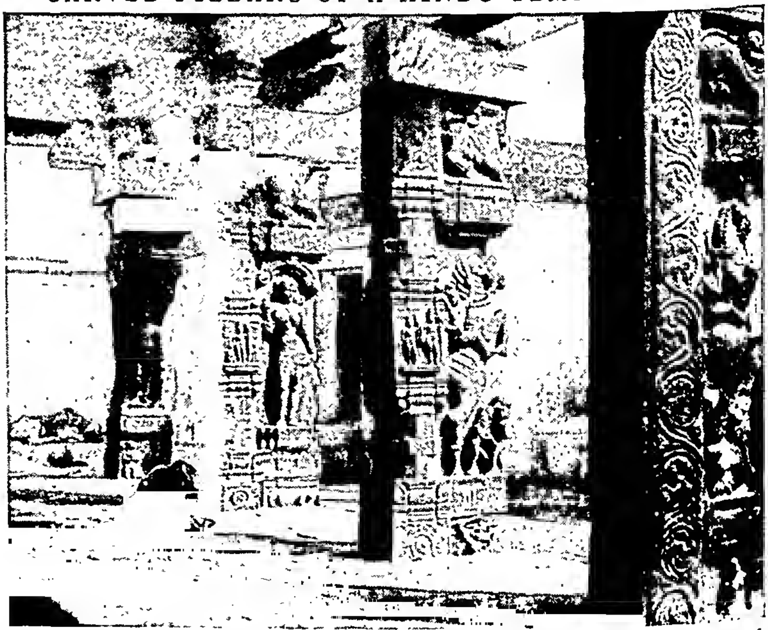
New literatures in the regional languages have been developing recently. In the 19th century the novelist Bankim Chandra Chatterji (1838–94), whose fiction was written after the European manner, influenced younger writers. Most distinguished of these was Sir Rabindranath Tagore (1861–1941). Tagore's poems, parables, dramas, and tales are admired for their beauty and simplicity. In 1913 he was awarded the Nobel prize for literature, and in 1915 he was knighted.

Indian music sounds peculiar to Western ears. It employs a different tone scale and contains no chords or harmony. It is made up of melody and rhythm only. When several instruments are used together, they play in unison. Songs, which are most important in Indian life, are also sung in unison. Among the instruments are varied drums, flutes, and stringed instruments—many of ancient origin. Dancing is one of India's ancient arts (*see* Dance, subhead "Dancing in India").

Republican Government and Constitution of India

India became a "sovereign, democratic republic" and a union of states when its constitution went into effect Jan. 26, 1950. Though the Indians had been under foreign rule for centuries and lacked experience in self-government, they had an age-old tradition of local government. Each village once had its council of five elders, called the *panchayat*, which settled disputes and looked after the general welfare. Elected officials included a headman, a watchman, and an accountant. The panchayat system had fallen into disuse during British rule, but it is being revived. Under the constitution both men and women may vote.

CARVED PILLARS OF A HINDU TEMPLE PORCH



In a land where religion and sculpture are close partners these pillars are typical. They are elaborately carved with gods and goddesses. Notice the sacred cows.

The constitution provides for a president, a cabinet headed by a prime minister, and a parliament of two houses—a House of the People and a Council of States. The House has 500 members, elected by popular vote. Members of the Council are elected by the state legislatures. There is a national judiciary system, with judges appointed by the central government. The supreme court of seven justices interprets the constitution.

The constitution contains a list of fundamental rights that are enforceable in the courts. It guarantees freedom of speech, liberty to all religious sects, and outlaws restrictions on "untouchables."

India's 28 states (29 if Kashmir-Jammu is counted) include former governors' provinces in British India, former princely states, and unions of princely states. *Part A states*, formerly governors' provinces, are headed by a governor appointed by the president. In *Part B states*, executive authority is held by a *rajpramukh*, one of the former princes. *Part C states* are controlled by the central government, with a commissioner acting as administrator. Andaman and Nicobar Islands make up a centrally governed territory. The state of Andhra was created from the Telegu-speaking districts of Madras in 1953.

India's Tangled History

The early history of India is lost in the mists of ancient traditions. Archaeological excavations at Mohenjo-daro and Harappa (now in Pakistan) reveal the existence of a civilization in the Indus Valley as long ago as 3000 B.C. The remains show that a city manner of living had developed in which the people had wells, bathrooms, drainage systems, handsome jewelry, and well-made household utensils and copper weapons. The 'Rig-Veda', written about 1500 B.C. tells of the struggle between the Aryan invaders and the "black people" who held the land. By the 6th century B.C., 16 Aryan states had been established south of the Himalayas, and Brahmanism was flourishing.

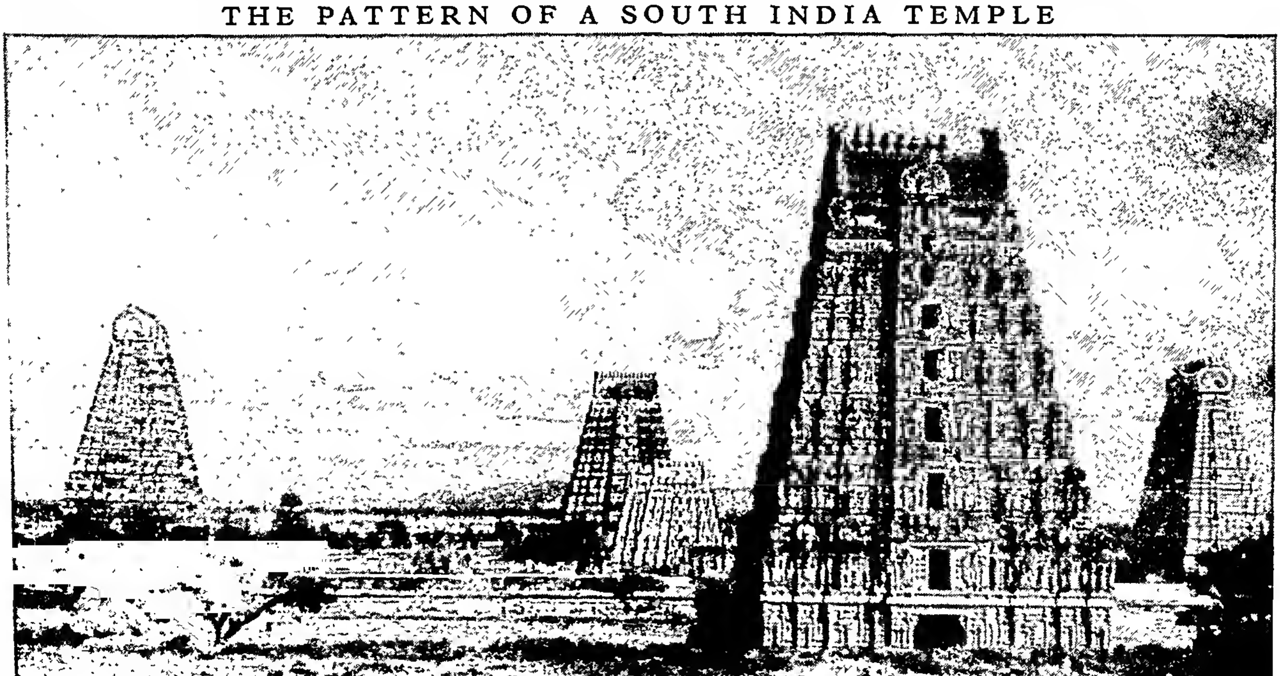
In 327 B.C. the armies of Alexander the Great reached the Hydaspes River, the modern Jhelum. Soon after Alexander's death in Babylon in 323 B.C., Chandragupta founded the Maurya empire. Under his grandson, Asoka, this empire extended over all India except the extreme south. It began to break up when Asoka became a devout Buddhist and sent forth missionaries instead of conquering armies. The next 13 centuries were marked by bitter struggles for power between Indian princes and by a succession of invaders, notably the White Huns in the 5th and 6th centuries A.D. The first attacks of the Moslems were repelled, but in the 11th century the Turkish leader Mahmud established the Ghazni dynasty. The Mongol invasion of Genghis Khan followed in 1219, and in 1397 Timur Leng's hordes poured in (*see* Mongols).

In 1526, Baber, a descendant of Genghis Khan and Timur Leng, came through the northwest passes from Afghanistan and seized the throne of Delhi, establishing the great Mogul Empire. This remained intact until the close of the 18th century. The south of India was never completely conquered, but the empire of the north, under such rulers as Akbar and Shah Jehan, was perhaps the most brilliant in the history of the Orient. During the reign of Aurangzeb (1619–1707), the last of the "great moguls," the power of the Mahrattas in the south arose. They so undermined the Mogul rule that it fell into weakness and decay.

Europe's Trading Powers Gain Supremacy

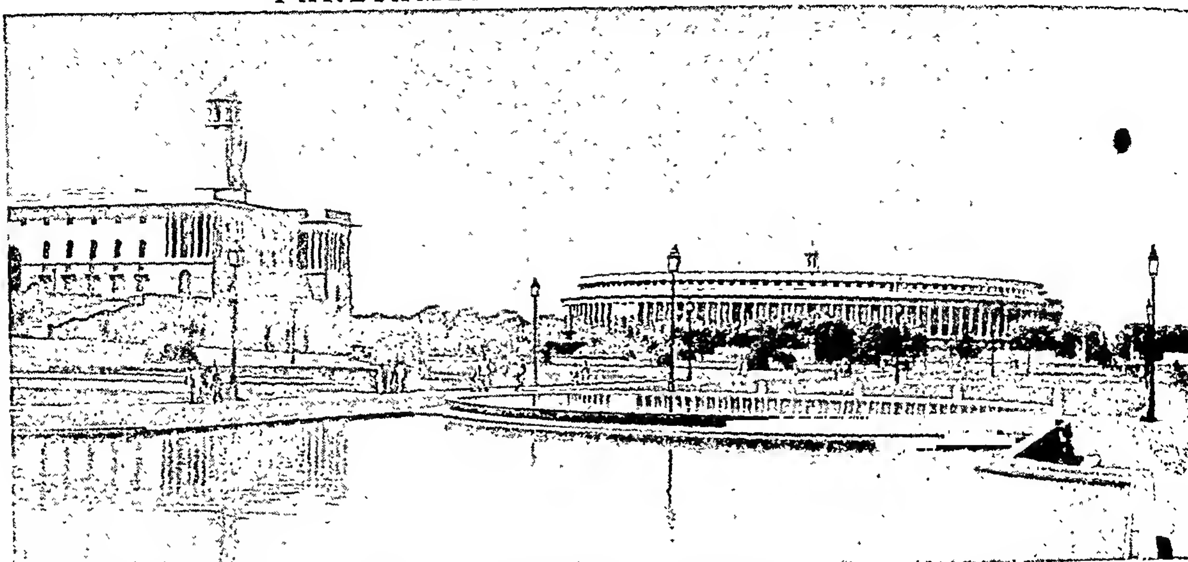
Meanwhile the struggle between European powers for dominance in Indian affairs had begun. With Vasco

THE PATTERN OF A SOUTH INDIA TEMPLE



This major temple square has four gateways marked by huge carved gopuras. The smaller pyramids, in the center, shelter the religious images. Every inch of the structures is intricately carved. The stormy sky is characteristic of monsoon months.

PARLIAMENT HOUSE IN NEW DELHI



The parliament of the Republic of India meets in the beautiful circular building beyond the reflecting pool. Surrounded by a colonnade half a mile around, it was built by the British when they created New Delhi as the capital of their Indian Empire.

da Gama's discovery of the ocean route around the Cape of Good Hope, Portugal, Holland, and France began a race for the rich Indian and Spice Islands trade. In 1600 the British East India Company joined in the rivalry and within a century had trading posts at Madras, Bombay, and Calcutta (then called Fort William). The French, under the leadership of a brilliant governor, Joseph Dupleix, organized an army of local troops. With them he interfered so successfully in the quarrels of Indian rulers that by 1751 the Carnatic and Deccan areas were under French influence.

When British influence was threatened with extinction in India, the genius of Robert Clive turned the tables. His storming and successful holding of Arcot in 1751 and then his victory at Plassey in 1757 overthrew the French power and laid the foundations of the rule of the British East India Company (*see* Clive). Later, trading rights gradually grew into political rule. It was a strange conquest, in which a private trading company conquered an empire chiefly through the use of soldiers (Sepoys) raised in the land itself.

Warren Hastings, who became governor general for the East India Company in 1774, built soundly upon the foundation Clive had laid (*see* Hastings). In the next 30 years the rule of the company was extended over a great part of India by conquest or treaties.

Certain high-handed methods employed by the British company, together with the teachings of missionaries and the advance of European customs, now stirred a great wave of unrest. In 1857 a rumor was circulated among the company's Indian soldiers that the cartridge papers they must tear with their teeth were greased with the fat of cows and pigs. The former animal is sacred to Hindus, and the latter abhorred by Moslems. This rumor started the great Indian Mutiny of 1857. The outbreak, though crushed, ended the powers of the East India Company. In 1858 the administration was transferred to the British Crown. In 1876 the British Parliament ruled that India should be designated an empire. The next year Queen Victoria was crowned Empress of India.

The Indian Empire

The viceroy of India, appointed by the crown, governed the empire. He ruled directly only the provinces included in British India. Hindu and Moslem princes continued to govern almost 600 *native, or princely, states*. These states were nominally independent, but were forbidden to make war on one another; and the viceroy kept an agent at each court to advise the ruler.

British rule brought internal peace and a measure of economic development to India. The British built roads and railways, canals, extensive irrigation works, and mills and factories. They introduced Western law and police systems, modernized cities, and built scattered schools and universities. On the whole the British civil service displayed a high order of ability and integrity, though their haughty aloofness aroused resentment. Indian intellectuals, many of them educated in English universities, soon began to dream of a free India. In 1885 they organized a political party, the National Congress, to further independence.

The Struggle for Independence

During the first World War Indian troops served the British loyally, but nationalist agitation increased afterward. The British Parliament passed the reform act of 1919, providing for provincial councils of Indians, with some supervision over agriculture, education, and public health. Far from satisfied, the extreme nationalists, led by Mohandas K. Gandhi, gained control of the Congress. Gandhi preached resistance to the British by "non-co-operation" (*see* Gandhi). Hundreds of thousands joined his civil disobedience campaigns. The Congress party quickly became the mass party of the people.

Rioting broke out when Parliament placed no Indians on the Simon commission appointed to investigate the government of India in 1927. The British imprisoned Gandhi and his associates. In 1929 Jawaharlal Nehru was elected president of the Congress. Like Gandhi, Nehru was passionately devoted to the cause of freedom. He had, however, absorbed Western ideas at Harrow and Cambridge and wanted to bring modern technology and industrialization to India.

After three "round table" conferences in London had considered the commission's report, Parliament passed a new Government of India act in 1935. It provided for elected legislatures in the provinces; but property and educational requirements restricted the number of voters to about 14 per cent of the population. To protect the interests of minorities, voting was by communal groups. Hindus, Untouchables, Moslems, and Sikhs voted for their own candidates. The system perpetuated religious strife. Mohammed Ali Jinnah, leader of the Moslem League, charged that Congress ministries mistreated their Moslem minorities. He agitated for the separation of the Moslem provinces from India and the creation of a state called Pakistan ("country of the pure").

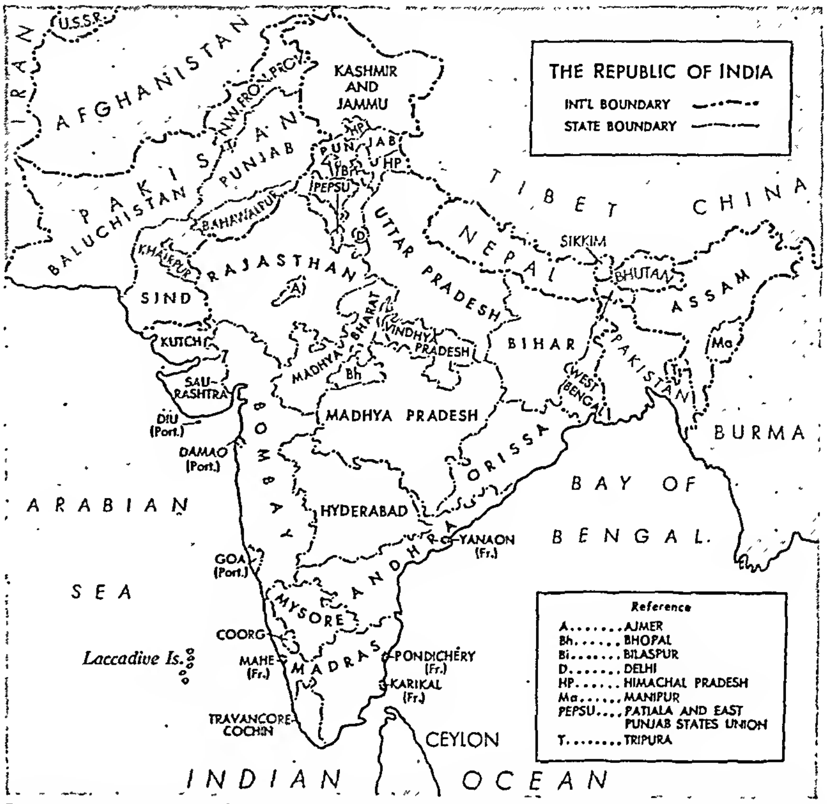
When the second World War broke out, the viceroy announced India's active participation. The Congress demanded complete and immediate freedom for India as the price of its cooperation. In 1942 Sir Stafford Cripps went to India with a plan for dominion status after the war, but Indian leaders could not agree on the terms. The Congress insisted on a unified India. The Moslem League demanded a separate Pakistan. The princes were determined to preserve their states.

The Japanese invaded northeast India from Burma with a small force in the spring of 1944. It was quickly driven out. In spite of opposition to British rule, India raised a volunteer army of more than 2 million. Its industries expanded greatly to supply arms and other goods to the empire.

Birth of the New Nations

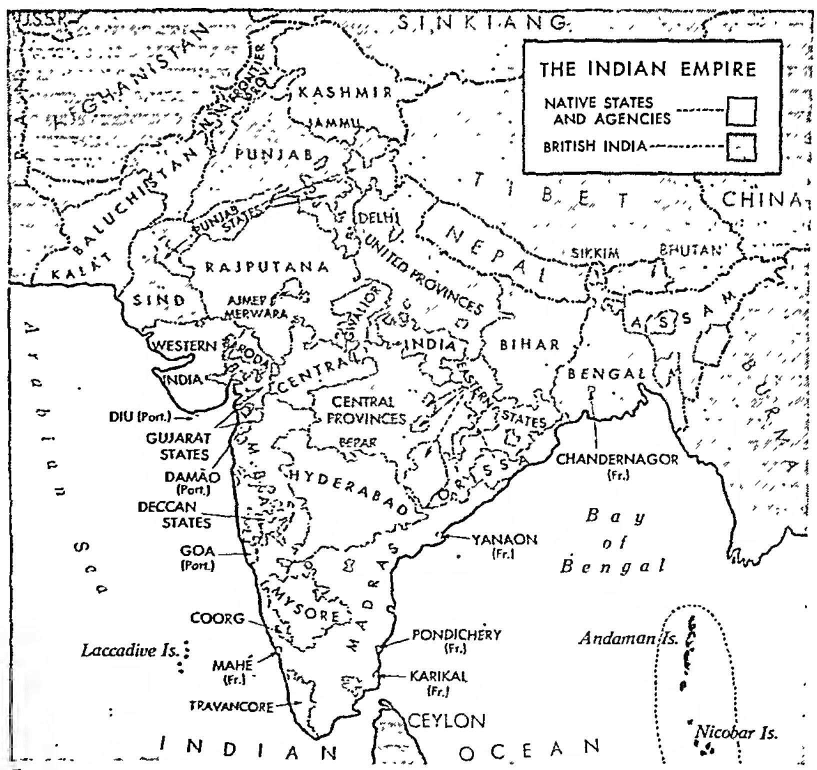
In February 1947, the British government announced it would leave India by June 1948, whether or not the Indians had settled their differences. Moslem threats of civil war

THE STATES OF THE REPUBLIC OF INDIA



Here are the states which compose India and Pakistan. Comparison with the Indian Empire map below reveals that the boundaries and names of former British provinces have been changed in many cases and that princely states have been grouped together. French and Portuguese areas are shown on both maps.

HISTORIC DIVISIONS OF INDIA UNDER BRITAIN



Great Britain ruled directly only British India. Its agents advised the heads of the princely states, called maharajas, rajas, nawabs, and nizams. British India, comprising 16 provinces, contained 76 per cent of the population. The princely states, from small feudal estates to large kingdoms, numbered 562.

then forced the Hindu leaders to agree to the establishment of the separate state of Pakistan. The British Parliament rushed through the Indian Independence bill in July. On Aug. 15, 1947, the Indian Empire came to an end. The two new dominions—India and Pakistan—had complete self-rule. Though they remained in the Commonwealth of Nations, they were free to withdraw. India took over the Indian Empire's membership in the United Nations.

Jinnah became the first governor general of Pakistan. He served until his death in 1948. Nehru, a moderate socialist, took office as India's first prime minister (*see* Nehru).

The boundaries between India and Pakistan were carefully worked out to separate Moslems from Hindus and Sikhs. The Punjab, Bengal, and Assam were split in two. Yet some 38 million Moslems remained in India, and approximately 19 million Hindus and more than $1\frac{1}{2}$ million Sikhs were left in Pakistan. When the new boundaries became known, rioting broke out. Thousands of the minority peoples were massacred. Hundreds of villages were burned in bitter communal strife. Then began one of the greatest migrations in history, as millions poured across the borders to the country of their own faith. Even this failed to end the violence.

On Jan. 30, 1948, a fanatical Hindu assassinated the aged and saintly Gandhi. Hindus and Moslems alike mourned his death. The Indian government immediately took strong action against the extremist Hindu group and communal strife subsided. In 1950 the two nations agreed to protect their religious minorities. In 1951 they concluded a trade agreement. By 1952 it was estimated that $7\frac{1}{2}$ million Hindus and Sikhs had fled from Pakistan into India, and 4 million Indian Moslems had entered Pakistan.

Status of Princely States and Foreign Areas

The Indian Independence Act applied only to the provinces of British India. The 562 native states were left outside both dominions. A few joined Pakistan. The rest were brought into India. Hyderabad, the largest princely state, insisted on remaining independent. India sent in troops, and in November 1948 it became a part of India (*see* Hyderabad).

Both India and Pakistan coveted Kashmir and Jammu, a large princely state in the extreme north. Pakistan sent in troops. The ruler of Kashmir joined his state to India and asked for India's help. For 14 months the two dominions waged an undeclared war in Kashmir. The fighting ended Jan. 1, 1949, when both sides ordered a "cease-fire" and agreed to allow the United Nations to hold a plebiscite in the disputed state. The voting was delayed because India insisted that Pakistan should first recall its troops (*see* Kashmir).

CAMPAIGNING IN THE REPUBLIC'S FIRST ELECTION

These peasants of Rajasthan have stopped their work to listen to the arguments of a candidate speaking from an oxcart. Well over half the 176 million eligible voters cast ballots. This is a higher percentage than go to the polls in most democracies.

When Britain withdrew from India, Portugal ruled Damão, a port settlement 100 miles north of Bombay; Diu (including the island of Diu and territories on the mainland), west of Damão; and Goa, on the Malabar Coast. The area of Portuguese India was 1,537 square miles. France held Pondichéry, Karikal, and Yanaon on the Coromandel Coast, Mahé on the Malabar Coast, and Chandernagor in Bengal. Their area totaled 196 square miles. In 1950 Chandernagor was joined to India after a plebiscite. In 1952 Nehru announced that India would not much longer tolerate the existence of foreign colonies on its territory.

The Young Republic Faces Its Problems

In 1949 India adopted the longest constitution in the world, and on Jan. 26, 1950, it became a republic, retaining its membership in the Commonwealth (*see* British Commonwealth and Empire). The problems of the new republic were aggravated by world conditions, particularly the conflict between the free world and Communism. Prime Minister Nehru attempted to steer a neutral course, hoping to maintain peaceful relations with India's Communist neighbors. Though the Communist party in India was small, it won 28 seats in the House of the People in the 1951–52 election by focusing its efforts in Madras and other southern states. Here drought and the concentration of landholding in a few hands increased peasant unrest.

The Congress party rolled up a large majority in the election. Rajendra Prasad, the first president, and Nehru remained in office. Because of the high percentage of illiteracy, the voters made their selections from pictured party symbols.

In 1951 the Planning Commission announced its five-year development plan, covering an array of irrigation, power, transportation, and community development projects and calling for an outlay of about 4 billion dollars. The government hoped to be able to supply funds for two thirds of the cost, but foreign

HEALTH WORKER TESTING FOR MALARIA

Health and child welfare agencies of the United Nations are aiding India's drive to control malaria. After extensive spraying with DDT, tests showed a great drop in infections.

assistance was necessary both in money and in technical co-operation.

By 1953 the International Bank for Reconstruction and Development had granted India six loans aggregating 1.18 million dollars. The first, received in 1949, was used to rehabilitate and improve the railway system. Other assistance from United Nations agencies included extensive projects dealing with forest resources, land reclamation, rice breeding, and pest control conducted by the Food and Agriculture Organization. The World Health Organization helped fight malaria, cholera, and tuberculosis.

Under the British Commonwealth's Colombo Plan, India had received by early 1953 more than 100 million dollars in cash, heavy machinery, and food grains. From the United States had come $88,350,000 and a $190,000,000 loan for the purchase of wheat during the famine conditions of 1950–51. The United States Technical Co-operation Administration made commitments of more than 50 million dollars in 1952 alone. This was used for American fertilizer, seed, and iron and steel for agricultural use, as well as for participation in a variety of projects. The work of private philanthropies in India included the Rockefeller Foundation's public health program and the Ford Foundation's support of 15 community projects and of training schools for rural workers.

Indian medical units served in the United Nations forces in the Korean conflict. After the armistice was signed, July 27, 1953, a representative of India became chairman of the Neutral Nations Repatriation Commission for war prisoners in Korea. Indian troops were sent to guard the prison camps.

REFERENCE-OUTLINE FOR STUDY OF INDIA

Note: In 1947 Britain's Indian Empire was divided. India and Pakistan became dominions in the British Commonwealth of Nations. In 1950 India renounced its dominion status and became a republic, although it remained a member of the Commonwealth. Burma had been administered as a province of British India until 1937, when it was separated from India and made a crown colony. In 1948 it withdrew from the Commonwealth and became an independent republic called the Union of Burma. Ceylon, which had been part of the presidency of Madras, became a crown colony in 1802 and achieved dominion status in 1948.

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BIBLIOGRAPHY FOR INDIA

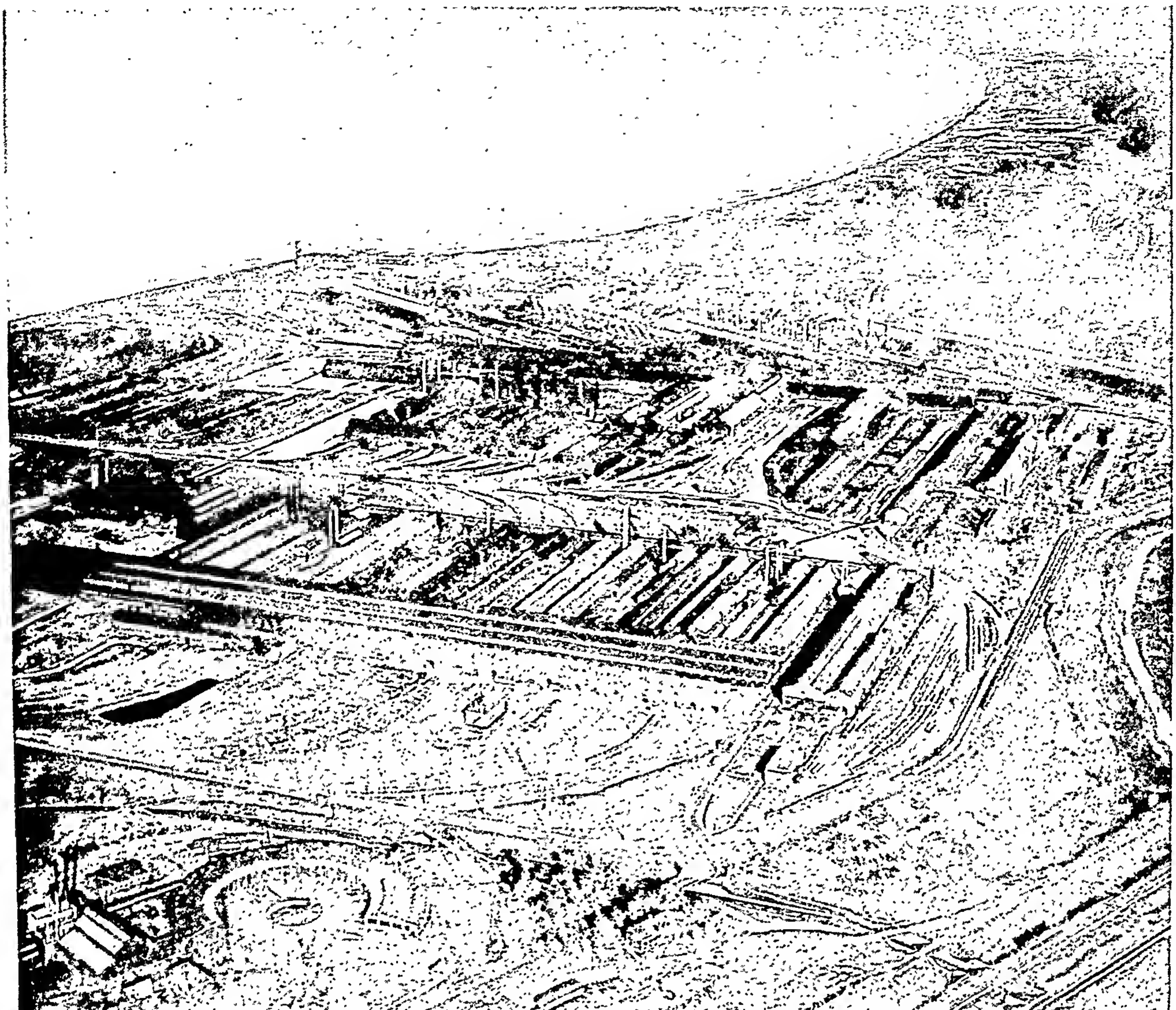
Books for Younger Readers

Batchelor, J. F. Cap for Mul Chand (Harcourt, 1950).
Bothwell, Jean. Story of India (Harcourt, 1952).
Bothwell, Jean. Sword of a Warrior (Harcourt, 1951).
Boulter, H. W. India (Holiday, 1944).
Eaton, Jeanette. Gandhi, Fighter Without a Sword (Morrow, 1950).
Kennedy, J. W. Here Is India (Scribner, 1945).
Kipling, Rudyard. Jungle Book (Grosset, 1950).
Kipling, Rudyard. Kim (Modern Library).
Masani, M. R. Our India (Oxford, 1948).
Masani, S. S. Nehru's Story (Oxford, 1949).
Metzger, Berta. Picture Tales from India (Lippincott, 1942).
Modak, M. R. Land and People of India (Lippincott, 1952).
Mukerji, D. G. Gay-Neck (Dutton, 1927).
Mukerji, D. G. Hari, the Jungle Lad (Dutton, 1924).
Weston, C. G. Bhimsa, the Dancing Bear (Scribner, 1945).
Yaukey, G. S. Made in India (Knopf, 1953).

Books for Advanced Students and Teachers

Bourke-White, Margaret. Halfway to Freedom (Simon & Schuster, 1949).
Brittain, Vera. Search after Sunrise (Macmillan, 1952).
Brown, W. N., ed. India, Pakistan, Ceylon (Cornell Univ. Press, 1951).
Brown, W. N. United States and India and Pakistan (Harvard Univ. Press, 1953).
Campbell-Johnson, Alan. Mission with Mountbatten (Dutton, 1953).
Corbett, Jim. My India (Oxford, 1952).
Datta, D. M. The Philosophy of Mahatma Gandhi (Univ. of Wis. Press, 1953).
Dunbar, G. D-F. India and the Passing of Empire (Philosophical Library, 1952).
Forster, E. M. Passage to India (Harcourt, 1949).
Ghose, S. N. And Gazelles Leaping (Macmillan, 1949).
Levi, Werner. Free India in Asia (Univ. of Minn. Press, 1952).
Moraes, R. R. and Stimson, Robert. Introduction to India (Oxford, 1947).
Moreland, W. H. and Chatterjee, A. C. Short History of India (Longmans, 1945).
Muehl, J. F. Interview with India (Day, 1950).
Nehru, Jawaharlal. Independence and After (Day, 1950).
Rama Rau, Santha. Home to India (Harper, 1945).
Rawlinson, H. G. India: a Short Cultural History (Praeger, 1953).
Roosevelt, Eleanor. India and the Awakening East (Harper, 1953).
Sen, G. E. Pageant of India's History, v. 1 (Longmans, 1948).
Wallbank, T. W. India in the New Era (Scott, 1952).
Wells, Carveth. Road to Shalimar (Doubleday, 1952).
Yaukey, G. S. Nehru of India (Day, 1948).

FACTORIES *and* FARMS *of the* "HOOSIER *State*"



Indiana's cities along the shore of Lake Michigan are important industrial centers. This huge steel mill at Gary gets iron ore from Minnesota and Michigan by boat, and coal from Illinois and Indiana by rail. It ships steel throughout the Midwest.

INDIANA. From high above the earth in midsummer, Indiana looks like a huge checkerboard of green meadows, brown plowed fields, and yellow squares of ripening grain. To the north, there are glittering lakes, scooped out by glaciers ages ago, and the land is cut by many shining rivers.

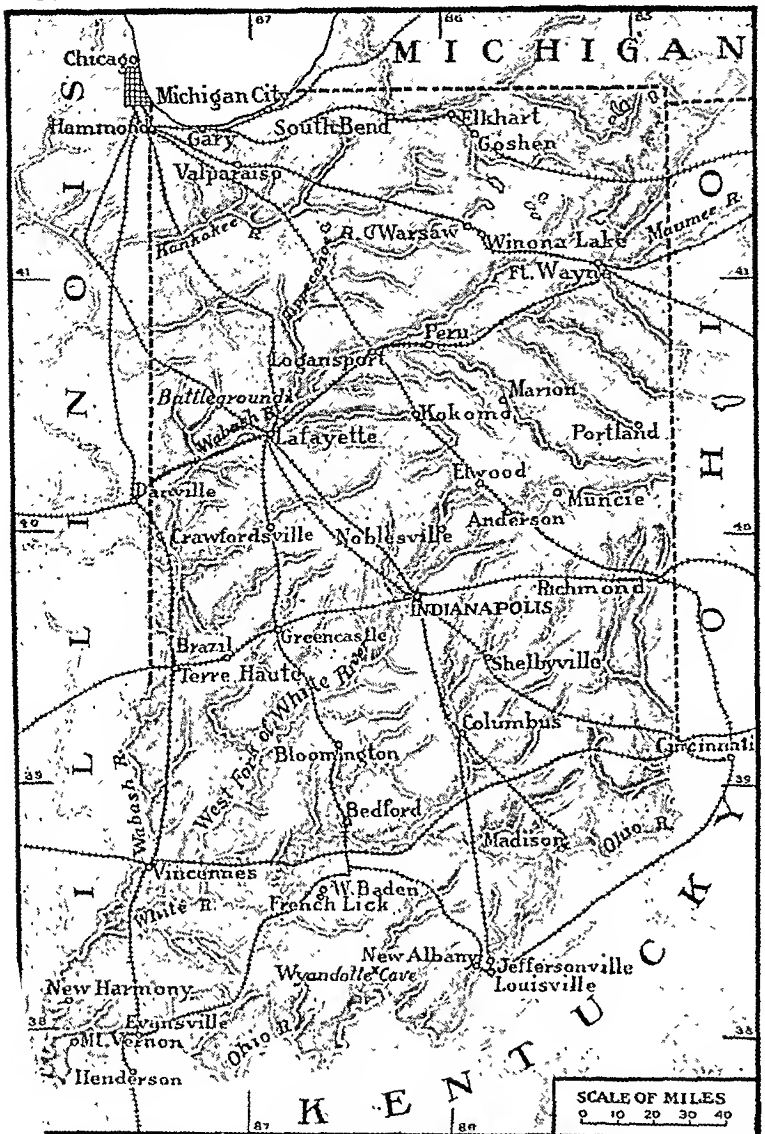
As a whole, the surface of the state is level. The highest part along the center of the Ohio border rises to an average of about 1,000 feet. From there it slopes down gently to the northwest, west, and southwest. It falls to 585 feet above sea level on the northwest margin along Lake Michigan. The lowest point in the state is 320 feet in the southwest along the Ohio River in Vanderburgh County.

Wind-blown sand dunes rise along the shores of Lake Michigan to a height of 400 feet. Some of the dunes are barren and desertlike. Others are covered with binder grass, cottonwood, scraggy pines, and oak. The central part of the state is a great agricultural plain. Its remarkable levelness and its rich soil make it an excellent farming area.

South of Indianapolis, the land becomes more broken. It rises into an irregular highland, cut by ages of weathering into beautiful and picturesque valleys. Brown County is especially beautiful when autumn turns the leaves to brilliant shades of red, brown, purple, and yellow. It is a favorite place for landscape painters.

A range of rocky hills, called the Knobstone Escarpment, runs southward from near Columbus to New Albany on the Ohio River. West of this formation lies almost level limestone land, riddled with caverns and "lost rivers" that suddenly disappear from sight. The Wabash lowland in southwestern Indiana

THE STATE THAT WAS NAMED FOR THE INDIANS



…en the United States started making states out of the wilderness, the land …t of Ohio was called Indiana Territory for its Indian inhabitants. In due time state took this name. Today it forms part of the prosperous heartland of the …ntry. Notice the lay of the land, with almost every river draining southwest into the Kankakee, the Wabash, or the Ohio.

is an alluvial plain. Glaciers left clay and lime drift over most of the state. Great forests later enriched the soil with humus. As a result, Indiana's topsoil is very fertile and its subsoil is 200 feet deep in some places.

Nature gave Indiana a favorable climate, which makes it an ideal region for farming. An annual rainfall of about 39 inches gives plenty of moisture for crops. An average winter temperature of approximately 30° "rests" the soil without freezing it too deeply. The average summer temperature of about 74° is excellent for plant growth. Thus, Indiana ranks among the leading states in value of farm income, although it is only the 37th state in area.

The name Indiana, which means "Indian land," is a memorial to the many red men who used to roam the region. When Ohio was set off from the original Northwest Territory in 1800, the remainder was called the Indiana Territory. It included the present states of Indiana, Illinois, and Wisconsin, as well as the western part of Michigan. In 1805, Michigan Territory was carved off on the north, and in 1809 the territory of Illinois (including Wisconsin) on the west. Thus Indiana acquired its present roughly rectangular shape and size.

Agriculture in Indiana

To a large extent, the foundation of Indiana's wealth is its corn crop and the production of animals raised on corn. Part of the "animal crop" is cattle, both beef and dairy breeds, but by far the largest part is hogs. Indiana ranks third among the states in the raising of hogs.

In wheat growing, Indiana takes a place among the leading states, since its climate is well suited to winter wheat. Soy beans, oats, and hay are other important crops. North of Indianapolis is a famous tomato-growing section. Minor but important crops are onions and mint in the northern muck lands, apples and peaches in the south central part, cantaloupes and watermelons in the southwest corner, and tobacco in some of the Ohio River counties. Milk, chickens, and eggs are also important sources of farm revenue.

There is little tendency toward large-scale agriculture in Indiana. The average size of a Hoosier farm is about 118 acres. But the crop yield for each acre, especially corn, is extremely high. Indiana ranks among the first half-dozen states in corn production.

Waterways and Highways

Indiana's rivers are numerous, and they are almost all historically important. They were the scenes of fierce fighting in the early days and were important highways of early commerce. The Wabash River system drains most of the state. The Ohio drains the southern border. The northern part is drained into Lake Erie through the Maumee, into Lake Michigan through the St. Joseph, and into the Illinois River and the Mississippi through the Kankakee. All these streams floated the canoes of the French trappers, fur traders, and Jesuit missionaries in the 18th century. The Ohio and its tributaries brought most of the first immigration from Virginia, Kentucky, and the Carolinas. The newcomers settled the southern part of the state in the late 18th and early 19th centuries. Many of the streams were the scenes of battles now half-forgotten. Only the name of Tippecanoe, where the Shawnee prophet was de-

Continued on page 83

Indiana Fact Summary

INDIANA (Ind.): From word *Indian* plus suffix *a*, meaning "Indian land."

Nickname: "Hoosier State," from Hoozer ("hill dweller"), because many settlers were descendants of Cumberland County (England) highlanders; or from pioneers' phrase "Who's yere?" meaning "Who is here?"

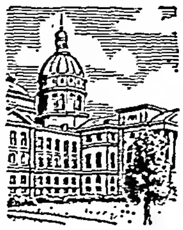
Seal: A woodsman fells a tree; a buffalo flees from the forest across the plains; the sun sets in the distance.

Motto: The Crossroads of America.

Flag: For description and illustration, *see* Flags.

Flower: Zinnia. **Bird:** Cardinal. **Tree:** Tulip tree. **Song:** 'On the Banks of the Wabash, Far Away', words and music by Paul Dresser.

THE GOVERNMENT



Capital: Indianapolis (site chosen 1820; moved from Corydon 1825).

Representation in Congress: Senate, 2; House of Representatives, 11. Electoral votes, 13.

General Assembly: Senators, 50; term, 4 years. Representatives, 100; term, 2 years. Convenes Thursday after first Monday in January in the odd-numbered years; the length of session, 61 days.

Constitution: Adopted 1851. Proposed amendment must be (a) passed by majority vote of each legislative house at two successive sessions and (b) ratified by majority voting on amendment at a popular election.

Governor: Term, 4 years. Consecutive terms prohibited.

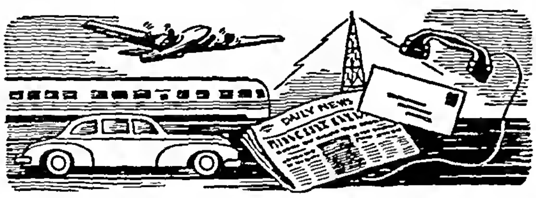
Other Executive Officers: Lieutenant governor, secretary of state, attorney general, treasurer, auditor, all elected; terms, 2 years, except lieutenant governor and attorney general, 4 years.

Judiciary: Supreme court—5 justices chosen by district; term, 6 yrs. Appellate court—6 judges; term, 4 yrs. Superior courts—25; judges' term, 4 yrs. Circuit courts—82; judges' term, 6 yrs. Probate courts—3; judges' term, 4 yrs. All judges elected.

County: 92 counties, each governed by 7 officers elected at large for 2 and 4 years, and board of 3 commissioners elected by commissioner districts.

Municipal: Cities—mayor and council; towns—town board and clerk-treasurer. Officers elected; term, 4 yrs.

Voting Qualifications: Age, 21; residence in state, 6 months; in township, 60 days; in district, 30 days.



TRANSPORTATION AND COMMUNICATION

Transportation: Railroads, 6,600 miles. First railroad, experimental Lawrenceburg and Indianapolis Railroad, at Shelbyville, 1834. Rural roads, 84,300 miles. Airports, 132.

Communication: Periodicals, 210. Newspapers, 394. First newspaper, *Indiana Gazette*, Vincennes, 1804. Radio stations (AM and FM), 67; first station, WSAZ (now WSBT), South Bend, licensed Sept. 25, 1921. Television stations, 5; first station, WFBM-TV, Indianapolis, began operation May 30, 1949. Telephones, 1,297,500. Post offices, 881.

THE PEOPLE AND THEIR LAND

Population (1950 census): 3,934,224 (rank among 48 states—12th); urban, 59.9%; rural, 40.1%. Density: 108.7 persons per square mile (rank—12th state).

Extent: Area, 36,291 square miles, including 86 square miles of water surface (37th state in size; same rank if Great Lakes area of 228 square miles is added).

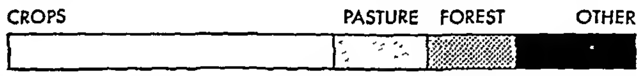
Elevation: Highest, 1,240 feet, near Crete; lowest, Ohio River at Vanderburgh County, 320 feet.

Temperature (°F.): Average—annual, 53°; winter, 30°; spring, 51°; summer, 74°; fall, 55°. Lowest recorded, −35° (Greensburg, Feb. 2, 1951); highest recorded, 116° (Collegeville, July 14, 1936).

Precipitation: Average (inches)—annual, 39; winter, 8; spring, 11; summer, 11; fall, 9. Varies from about 34 in north (except northeast tip) to about 46 in south.

Natural Features: Three great regions—northern lake country; central agricultural plains; and hills and lowlands of southern section. In northwest along Lake Michigan are the famous sand dunes. Principal rivers: Kankakee, Maumee, Ohio, St. Joseph (flowing into Lake Michigan), Wabash, and White.

Land Use: Cropland, 52%; nonforested pasture, 15%; forest, 14%; other (roads, parks, game refuges, wasteland, cities, etc.), 19%.



Natural Resources: *Agricultural*—level land, rich soil; ample precipitation; long growing season. *Industrial*—minerals (coal, petroleum, cement, stone, sand and gravel, and clays); water supply; hardwood timber. *Commercial*—Calumet area adjoining Chicago, ideal site for large mills, factories, and refineries. Scenic interest attracts many vacationers and artists.

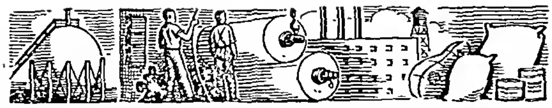
OCCUPATIONS AND PRODUCTS

What the People Do to Earn a Living

Major Industries and Occupations, 1950

Fields of Employment	Number Employed	Percentage of Total Employed
Manufacturing	527,836	34.6
Wholesale and retail trade	266,487	17.6
Agriculture, forestry, and fishery	176,103	11.6
Professional services (medical, legal, educational, etc.)	115,029	7.6
Transportation, communication, and other public utilities	112,914	7.4
Construction	77,420	5.1
Personal services (hotel, domestic, laundering, etc.)	71,983	4.7
Government	47,923	3.2
Finance, insurance, and real estate	39,277	2.6
Business and repair services	32,806	2.2
Mining	15,279	1.0
Amusement, recreation, and related services	11,843	0.8
Workers not accounted for	23,542	1.6
Total employed	1,518,442	100.0

Indiana Fact Summary



What the People Produce

A. Manufactured Goods (Rank among states—8th)
Value added by manufacture* (1952), $4,464,882,000

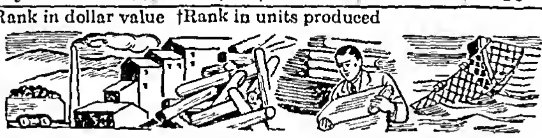
Leading Industries in 1947 (with Principal Products)	Value Added by Manufacture	Rank among States
PRIMARY METAL INDUSTRIES...... Blast furnaces and steel mills; iron and steel foundries; wire drawing; nonferrous metal rolling and drawing	$449,218,000	4
TRANSPORTATION EQUIPMENT...... Motor vehicles and parts; railroad cars and streetcars	442,080,000	4
MACHINERY (EXCEPT ELECTRICAL). Refrigeration machinery; power-transmission equipment; farm machinery; internal-combustion engines	402,520,000	7
FOOD AND KINDRED PRODUCTS..... Distilled liquors; meat packing; bakery products; canned fruits, vegetables, and soups; malt liquors	291,404,000	10
ELECTRICAL MACHINERY.......... Radios and related products; electrical industrial apparatus	252,527,000	7

*For explanation of value added by manufacture, *see* Census.

B. Farm Products (Rank among states—9th)
Total cash income (1952), $1,118,576,000

Products	Amount Produced (10-Year Average)	Rank within State*	Rank among States†
Corn...........	212,069,000 bu.	1	4
Hogs..........	1,547,463,000 lbs.	2	3
Milk...........	1,655,000,000 qts.	3	12
Cattle..........	475,473,000 lbs.	4	13
Eggs...........	162,000,000 doz.	5	12
Soybeans.......	25,013,000 bu.	6	3
Wheat.........	29,529,000 bu.	7	12
Hay...........	2,534,000 tons	8	16

*Rank in dollar value †Rank in units produced



C. Minerals (Fuels, Metals, and Stone)
Annual value (1951), $174,389,000
Rank among states—19th

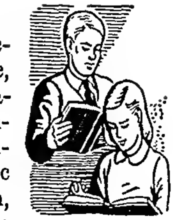
Minerals (1951)	Amount Produced	Value
Coal....................	19,451,000 tons	$78,617,000
Petroleum..............	11,100,000 bbls.	30,530,000
Cement*...............	....	....
Stone..................	8,642,000 tons	23,730,000
Sand and gravel.........	11,031,000 tons	8,764,000
Clays..................	1,267,000 tons	1,657,000

*Cement ranks 3d in value; exact figures not available.

D. Trade

Trade (1948)	Sales	Rank among States
Wholesale..........	$3,261,958,000	15
Retail.............	3,532,337,000	11
Service............	271,297,000	13

EDUCATION



Public Schools: Elementary, 2,150; secondary, 762. Compulsory school age, 7 through 16. State Board of Education composed of 3 separate commissions; membership in each consists of the state supt. of public instruction, elected for 2-year term, and 6 members appointed by the governor for 4-year terms. County supts. elected by township trustees for 4-year terms. City school boards elected except in a few cities where appointed by mayor. City supts. elected by city boards of trustees.

Private and Parochial Schools: 421.

Colleges and Universities (accredited): Colleges, 31; junior colleges, 1. State-supported schools include Indiana University with campuses at Bloomington and Indianapolis; Purdue University, West Lafayette; Ball State Teachers College, Muncie; Indiana State Teachers College, Terre Haute.

State Schools for the Handicapped: Indiana State School for the Blind, Indianapolis; Indiana State School for the Deaf, Indianapolis.

Libraries: City and town public libraries, 240; independent county library systems, 2; 22 counties contract for service with city libraries. Extension Division of State Library responsible for aid in developing public library service. State Department of Education and State Library responsible for aid in developing school library service; work headed by director of school libraries and teaching materials. Noted special library: Historical Society Library, Indianapolis.

Outstanding Museums: John Herron Art Institute, Indianapolis; Children's Museum of Indianapolis, Indianapolis; Fort Wayne Art School and Museum, Fort Wayne; Evansville Public Museum, Evansville; Sheldon Swope Art Gallery, Terre Haute.

CORRECTIONAL AND PENAL INSTITUTIONS

Indiana Girls' School, Indianapolis; Indiana Boys' School, Plainfield; Indiana Reformatory, Pendleton; Indiana Woman's Prison, Indianapolis; Indiana State Farm, Greencastle; Indiana State Prison, Michigan City.

STATE PARKS*

Bass Lake Beach—facilities for swimming, fishing (5).
Brown County—scenery is popular art subject (20).
Clifty Falls—deep gorge with waterfalls; view of Ohio River and Kentucky hills (28).
Indiana Dunes—sandy beach on shore of Lake Michigan; bordered by dunes and forested area (3).
Kankakee River—fishing and wildlife study in vast swamp; east of (5).
Lincoln—Lincoln's Indiana boyhood home; lake (42).
McCormick's Creek—limestone canyon; many trails (16).
Mounds—mounds believed built by early Indians (11).
Muscatatuck—rugged country on river banks (24).
Pokagon—summer and winter resort on the shores of Snow Lake and Lake James (2).
Scales Lake Beach—lake in strip mine area; s. w. of (42).
Shades—dense woods and deep ravines; n. e. of (13)
Shakamak—national swimming and diving meets; 2 lakes; small coal mine on exhibition (19).
Spring Mill—reconstructed stone village with gristmill, post office, and shops restored; caverns (27).
Tippecanoe River—park along Tippecanoe River (6).
Turkey Run—deep canyons cut by water erosion (13).

*Numbers in parentheses are keyed to map.

Indiana Fact Summary

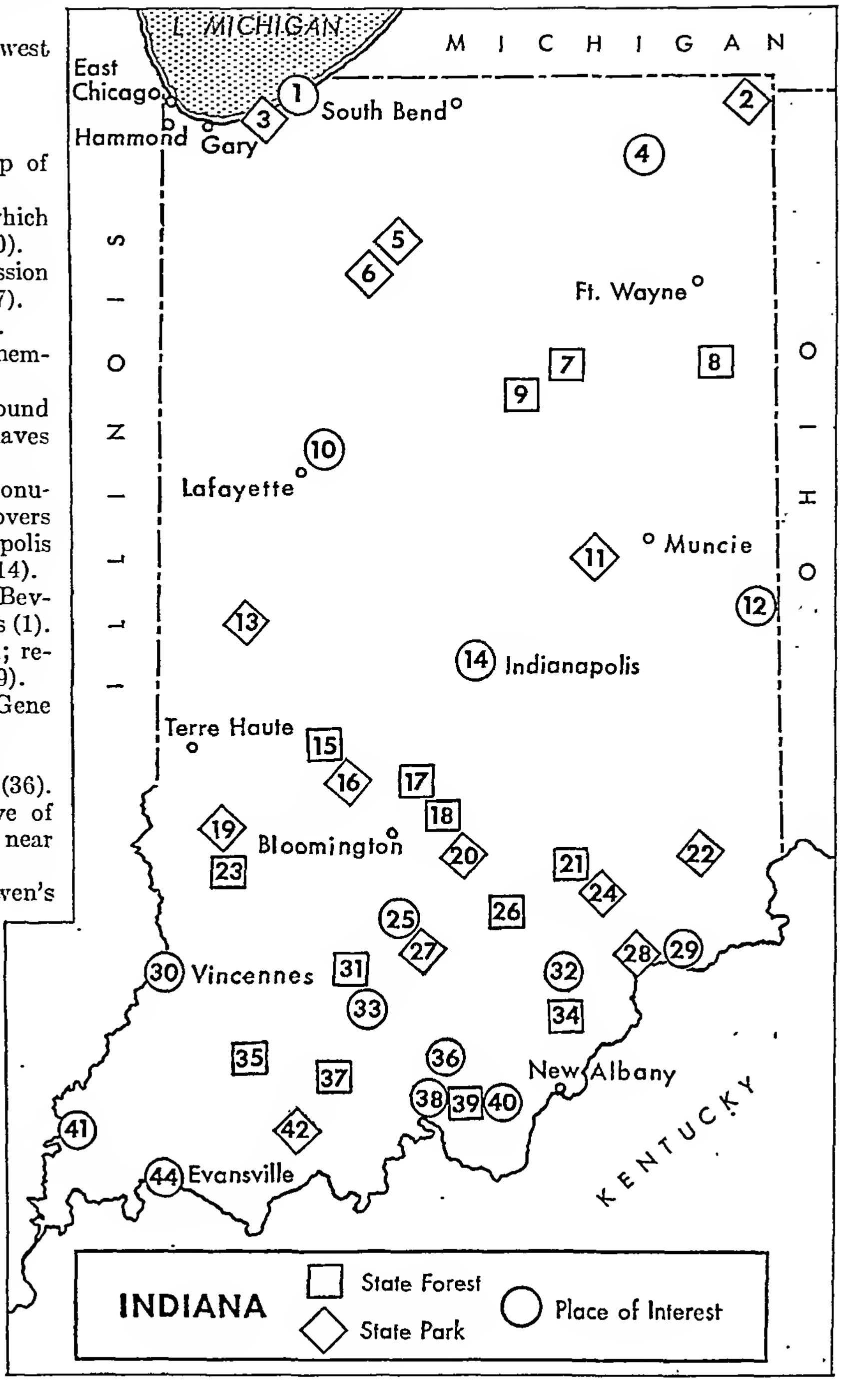
Versailles—large recreation area (22).
Whitewater—dam forms lake; southwest of symbol (12).

PLACES OF INTEREST*

Angel Mounds Memorial—largest group of prehistoric mounds in Indiana (44).
Corydon—first state capital; elm under which legislators talked over state affairs (40).
Easter Pageant—annual sunrise passion play at Marion; southeast of symbol (7).
French Lick Springs—health resort (33).
George Rogers Clark Memorial—commemorates winning of old Northwest (30).
"Grand Central Station" of the Underground Railroad—Fountain City; runaway slaves stopped here en route to Canada (12).
Indianapolis—Soldiers' and Sailors' Monument; Indiana World War Memorial covers 5 city blocks; State Capitol; Indianapolis Motor Speedway (*see* Indianapolis) (14).
International Friendship Gardens—in Beverly Shores; plants of dunes and marshes (1).
J. F. D. Lanier Memorial—in Madison; restored mansion of Civil War period (29).
Limberlost Memorial—home of author Gene Stratton Porter; near Rome City (4).
Limestone Quarries—near Bedford (25).
Marengo Cave—stalactites, stalagmites (36).
Nancy Hanks Lincoln Memorial—grave of mother of President Lincoln; shrine; near Lincoln City and (42).
New Harmony—site of Robert Owen's socialistic community (41).
Pigeon Roost Memorial—commemorates massacre of settlers by Indians (1812); near Underwood (32).
T. C. Steele Memorial—artist's estate; near Belmont and (20).
Tippecanoe Battlefield Memorial—nr. Lafayette; where William H. Harrison's troops battled Indians (10).
Vincennes—first settlement in Indiana and old territorial capital; Vincennes University (30).
Wyandotte Cave—near Leavenworth; impressive limestone formations (38).

NATIONAL FOREST*

Hoosier—781,467 acres; headquarters, Bedford; near symbol (25).



STATE FORESTS*

Clark (Clark County)—17,808 acres (34).
Ferdinand (Dubois County)—5,408 acres (37).
Frances Slocum (Miami-Wabash Cos.)—1,087 acres (9).
Greene-Sullivan (Greene-Sullivan Cos.)—3,825 a. (23).
Harrison (Harrison County)—17,764 acres (39).
Jackson (Jackson County)—5,538 acres (26).
Martin (Martin County)—3,579 acres (31).
Morgan-Monroe (Morgan-Monroe Cos.)—20,065 a. (17).
Owen (Owen-Putnam Cos.)—1,625 acres (15).
Pike (Pike County)—2,650 acres (35).
Salamonie River (Wabash County)—805 acres (7).
Selmier (Jennings County)—352 acres (21).
Wells (Wells County)—971 acres (8).
Yellowwood (Brown County)—19,500 acres (18).

*Numbers in parentheses are keyed to map.

LARGEST CITIES (1950 census)

Indianapolis (427,173): state capital; railroad center; large livestock market; manufactures aircraft and automotive engines and parts, radios, and drugs.
Gary (133,911): world's largest steel-producing area.
Fort Wayne (133,607): agricultural shipping point; manufactures tanks, pumps, radios, electric appliances.
Evansville (128,636): makes refrigerators and equipment.
South Bend (115,911): manufactures automobiles, trucks, aviation accessories, agricultural equipment, and machinery; University of Notre Dame.
Hammond (87,594): steel products; soap, corn products.
Terre Haute (64,214): coal and clay region; canning.
Muncie (58,479): produces glass jars, auto parts.
East Chicago (54,263): rail and lake shipping; blast furnaces; iron and steel products; oil refining.

Indiana Fact Summary

THE PEOPLE BUILD THEIR STATE

1671—French at Sault Ste. Marie claim all "the West"; later France includes present Indiana in this region; British also lay claim to the area.
1675—Father Jacques Marquette may have crossed dunes at Indiana end of Lake Michigan.
1679—René Robert Cavelier, Sieur de La Salle, explores St. Joseph River from the mouth to its "south bend"; portages to Kankakee River and descends that stream to the Illinois River.
1681—La Salle returns to "south bend," holding council there with Miami and Illinois Indians under the Council Oak; he explores Indiana area widely in next years.
1682—La Salle claims entire Mississippi Valley for Louis XIV of France, naming area "Louisiana."
1732—French troops under François de Vincennes build fort on site of Vincennes, first permanent white settlement in present state of Indiana.
1763—Indiana included in territory ceded by France to Great Britain. In Pontiac Conspiracy, Indians ravage Indiana settlements, destroying Forts Ouiatenon (near present Lafayette) and Miami (later Fort Wayne); peace restored after 1764.
1777—Fort at Vincennes rebuilt as Fort Sackville by British to attack American frontier.
1778—Men representing George Rogers Clark occupy Fort Sackville raising American flag; British recapture fort, December 17; Clark retakes it, Feb. 24, 1779, after heroic forced march from Kaskaskia, Ill.; fort renamed Fort Patrick Henry.
1783—Indiana is included in territory ceded by Britain to U. S.
1784—Virginia relinquishes its claim to Indiana region.
1787—Northwest Territory, including Indiana, organized; settlers begin to pour into Ohio Valley.
1790—U. S. troops attack Indian villages in Indiana region, leading to severe conflicts.
1794—Gen. Anthony Wayne defeats Miami Indians at battle of Fallen Timbers in Ohio, August 20; he builds Fort Wayne. Indians cease attacks, 1795; cede some land in Indiana region to U. S.
1800—Indiana Territory created; territorial government begins, July 4; capital, Vincennes; William Henry Harrison appointed governor; later he concludes first of series of Indian treaties.
1803—Swiss settlers introduce grape culture.
1805—Indiana Territory reduced by creation of Michigan Territory; reduced to present boundaries by formation of Illinois Territory, 1809.
1809—Governor Harrison concludes Treaty of Fort Wayne with Indians, September 30, acquires southwestern Indiana.
1811—Harrison builds Fort Harrison at site of Terre Haute; attacks and defeats Indians at battle of Tippecanoe, November 6–7.
1812—U. S. at war with Britain; Indians renew attacks under Tecumseh; Forts Harrison and Wayne are besieged; Indians routed, December 17–18; Tecumseh killed, Oct. 5, 1813.
1813—Territorial capital moved to Corydon, March 11.
1815—Society of Rappites settles at New Harmony.
1816—Indiana admitted to the Union, December 11, as 19th state; capital, Corydon; governor, Jonathan Jennings. Slavery prohibited by constitution but not finally ended in state until 1843; state constitution is first to provide for graduated system of state-supported schools.
1818—By Treaty of St. Marys central Indiana is purchased from Indians; opened to settlement, 1820.
1820—Committee selects site of Indianapolis for new capital, June 7, state government moved there by 1825.
1824—State Seminary opens at Bloomington; becomes Indiana College in 1828, Indiana Univ. in 1838.
1825—Robert Owen founds New Harmony Community of Equality, socialistic experiment; it fails, 1829.
1830—Construction of Wabash and Erie Canal starts; first section opened in 1835.
1837—Remaining Indians, Potawatomies, driven from state. David Dale Owen begins geological survey of state; his findings lead to development of coal and limestone mining; first commercial coal mining begun at Canneton; first large mine opened in Sullivan County, 1854.
1840—William H. Harrison elected 9th president of U.S.
1842—University of Notre Dame founded at South Bend.
1851—Present state constitution ratified.
1852—First Indiana State Fair opens. State public-school system created. Studebaker brothers begin wagon manufacturing in South Bend.
1863—Confederate Gen. John Morgan raids and loots Corydon, Salem, Dupont, and Versailles.
1866—*Robert E. Lee*, fastest steamboat on Mississippi River in its time, built at New Albany.
1868—James Oliver invents chilled-iron plow at South Bend; founds farm-implement industry which opens way to greater development of agriculture.
1869—John Purdue of Lafayette presents state with land and money for Purdue University; opened, 1874.
1880—Gen. Lew Wallace, born at Brookville, publishes 'Ben Hur', one of all-time best-selling novels.
1883—James Whitcomb Riley, born at Greenfield, publishes his first book of Hoosier-style verse.
1886—First natural-gas wells in state opened at Portland.
1888—Benjamin Harrison, Indianapolis lawyer and senator from Indiana, 1881–87, elected 23d president of U. S.
1889—State's first oil well drilled near Keystone. Standard Oil Company builds refinery at Whiting, one of the largest in the world.
1893—Inland Steel Company plant built at East Chicago.
1894—Elwood Haynes, born at Portland, develops an automobile; makes trial run at Kokomo.
1906—U. S. Steel Corporation builds plant in Calumet region; city of Gary founded for steelworkers.
1911—First 500-mile Memorial Day auto race held at Indianapolis.
1936—Negroes permitted to serve in state militia.
1937—Ohio River flood ravages southern Indiana; leads to extensive Ohio Valley flood-control program.
1940—Wendell Willkie, born at Elwood, is Republican nominee for president of the U. S. but is defeated by Franklin D. Roosevelt. Large powder plant built near Charlestown in U.S. rearmament effort.
1945—Public Employees Retirement Law enacted.
1950—Indiana Territory's 150th anniversary observed.
1951—Welfare rolls made public; federal aid cut off, then restored when Congress permits publication of lists.
1954—Northern Indiana toll road, between Ohio and Illinois borders, begun. Congress approves U.S. participation with Canada in the St. Lawrence Seaway Project; Gary and Michigan City may become ocean ports.

INDIANA

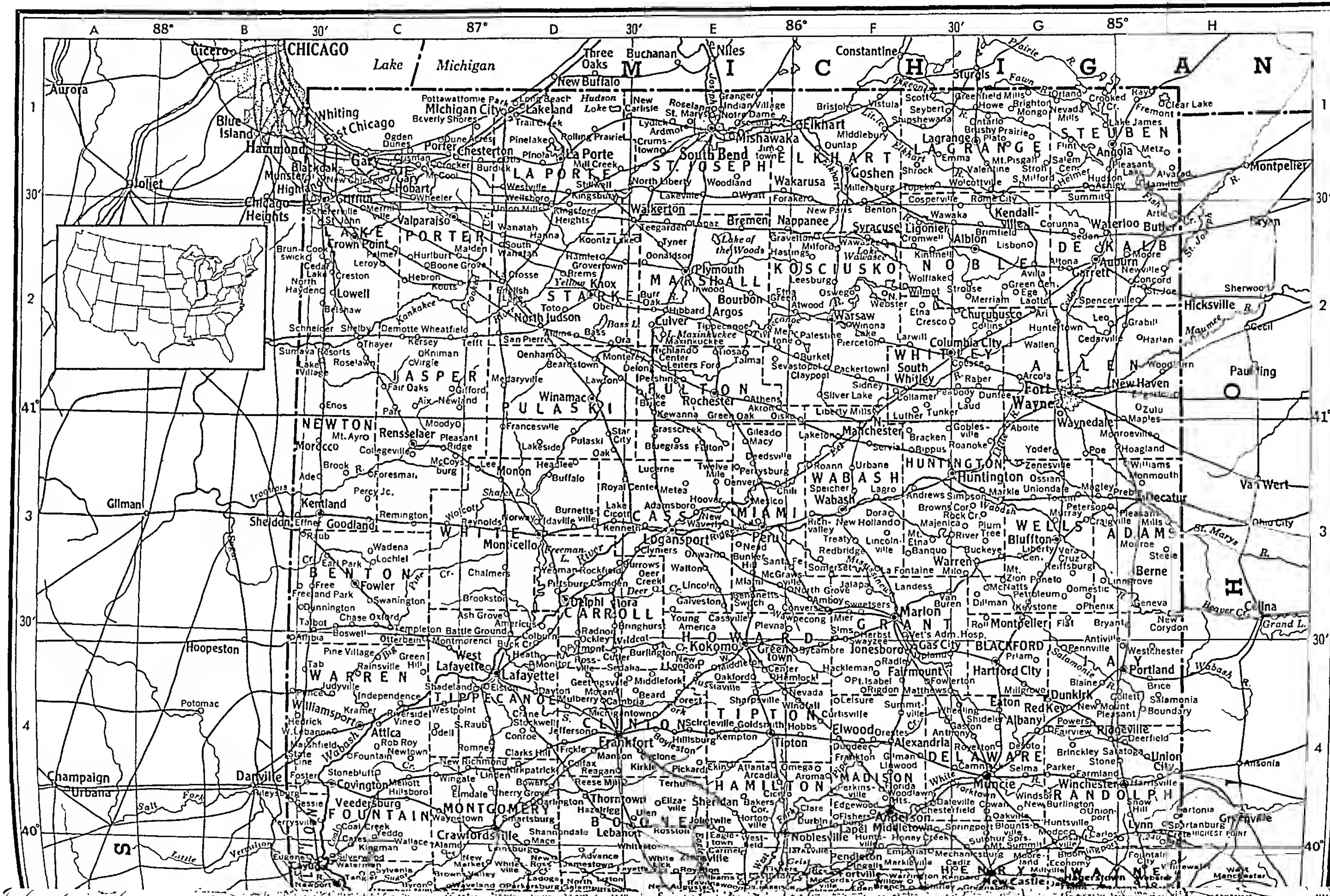
COUNTIES

Adams	22,393	H 3
Allen	183,722	G 2
Bartholomew	36,108	F 6
Benton	11,462	C 3
Blackford	14,026	G 4
Boone	23,993	E 4
Brown	6,209	E 6
Carroll	16,010	D 3
Cass	38,793	E 3
Clark	48,330	F 8
Clay	23,918	C 6
Clinton	29,734	E 4
Crawford	9,289	E 8
Daviess	26,762	C 7
De Kalb	26,023	H 2
Dearborn	25,141	H 6
Decatur	18,218	G 6
Delaware	90,252	G 4
Dubois	23,785	D 8
Elkhart	84,512	F 1
Fayette	23,391	G 5
Floyd	43,955	F 8
Fountain	17,836	C 4
Franklin	16,034	G 6
Fulton	16,565	E 2
Gibson	30,720	B 8
Grant	62,156	F 3
Greene	27,886	D 6
Hamilton	28,491	E 4
Hancock	20,332	F 5
Harrison	17,858	E 8
Hendricks	24,594	D 5
Henry	45,505	G 5
Howard	54,498	E 4
Huntington	31,400	G 3
Jackson	28,237	E 7
Jasper	17,031	C 2
Jay	23,157	G 4
Jefferson	21,613	G 7
Jennings	15,250	F 7
Johnson	26,183	E 6
Knox	43,415	C 7
Kosciusko	33,002	F 2
La Porte	76,808	D 1
Lagrange	15,347	G 1
Lake	368,152	C 2
Lawrence	34,346	E 7
Madison	103,911	F 4
Marion	551,777	E 5
Marshall	29,468	E 2
Martin	10,678	D 7
Miami	28,201	E 3
Monroe	50,080	D 6
Montgomery	29,122	D 4
Morgan	23,726	E 6
Newton	11,006	C 3
Noble	25,075	G 2
Ohio	4,223	H 7
Orange	16,879	E 7
Owen	11,763	D 6
Parke	15,674	C 5
Perry	17,367	D 8
Pike	14,995	C 8
Porter	40,076	C 2
Posey	19,818	B 8
Pulaski	12,493	D 2
Putnam	22,950	D 5
Randolph	27,141	G 4
Ripley	18,763	G 6
Rush	19,799	G 5
St. Joseph	205,058	E 1
Scott	11,519	F 7
Shelby	28,026	F 5
Spencer	16,174	C 9
Starke	15,282	D 2
Steuben	17,087	G 1
Sullivan	23,667	C 6
Switzerland	7,599	G 7
Tippecanoe	74,473	D 4
Tipton	15,566	E 4
Union	6,412	H 5
Vanderburgh	160,422	B 8
Vermillion	19,723	C 5
Vigo	105,160	C 6
Wabash	29,047	F 3
Warren	8,535	C 4
Warrick	21,527	C 8
Washington	16,520	E 7
Wayne	68,566	G 5
Wells	19,564	G 3
White	18,042	D 3
Whitley	18,828	F 2

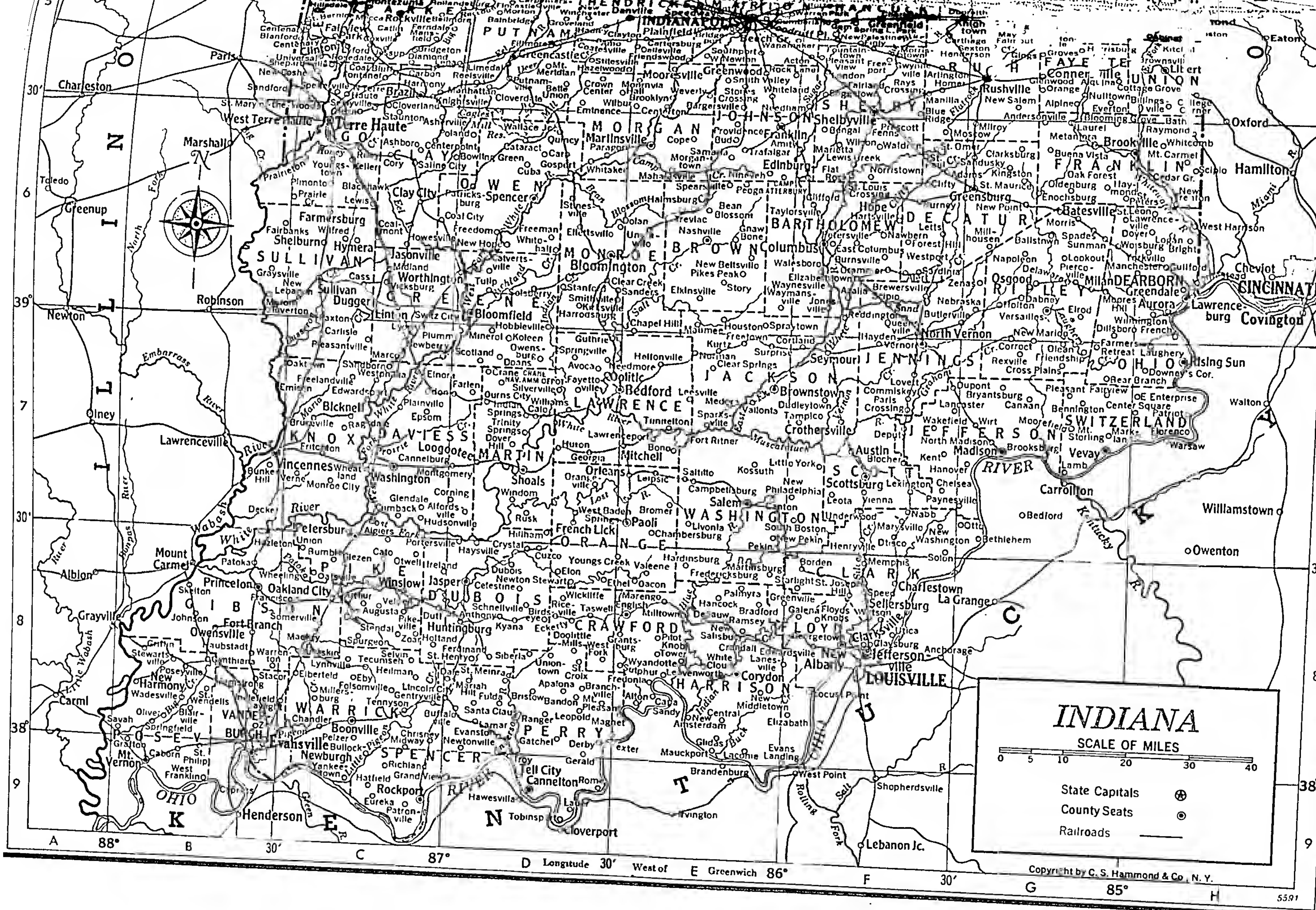
CITIES AND TOWNS

Abington	200	H 5
Aboite	50	G 3
Acton		E 5
Adams	350	F 6
Adamsboro	150	E 3
Ade	90	C 3
Advance	413	D 5
Aix		C 2
Akron	946	E 2
Aladdin	19	*F 4
Alamo	163	C 5
Albany	1,846	G 4
Albion	1,341	G 2
Aldine	75	D 2
Alert	110	F 6
Alexandria	5,147	F 4
Alfordsville	101	C 7
Algiers	102	C 7
Alpine	55	G 5
Alquina	114	G 5
Alton	71	E 8
Altona	344	G 2
Alvarado		H 1
Ambia	356	C 4
Amboy	414	F 3
Americus	105	D 3
Amity	150	E 6
Amo	354	D 5
Anderson	46,820	F 4
Andersonville	250	G 5
Andrews	1,083	F 3
Angola	5,081	G 1
Anthony	50	G 4
Antiville	14	G 3
Apalona	14	D 8
Arba	84	H 4
Arcadia	1,073	E 4
Arcola	272	G 2
Ardmore	6,000	E 1
Argos	1,284	E 2
Ari	29	G 2
Arlington	430	F 5
Armstrong	155	B 8
Aroma	30	F 4
Arthur	225	C 8
Artic	50	H 2
Ash Grove	14	D 3
Ashboro	100	C 6
Asherville		C 6
Ashley	680	G 1
Athens	105	E 2
Atlanta	613	E 4
Attica	3,862	C 4
Atwood	300	F 2
Auburn	5,879	G 2
Augusta	117	C 8
Aurora	4,780	H 6
Austin	2,906	F 7
Avilla	669	G 2
Avoca	400	D 7
Azalia	100	F 6
Bacon		E 8
Bainbridge	455	D 5
Bakers Corner	75	E 4
Ballstown	3	G 6
Bandon		D 8
Banquo	105	F 3
Bargersville	413	E 5
Bartonia	26	H 4
Bass	40	D 2
Batesville	3,194	G 6
Bath	95	H 5
Battle Ground	634	D 3
Bean Blossom	74	E 6
Bear Branch	120	G 7
Beard	20	E 4
Beardstown	50	D 2
Bedford	12,562	E 7
Beech Grove	5,685	E 5
Belle Union	75	D 5
Belleville		E 5
Bellmore	120	C 5
Belshaw	100	C 2
Bengal	35	F 6
Bennetts Switch	120	E 3
Bennington	50	G 7
Benton	225	F 2
Bentonville	77	G 5
Berne	2,277	H 3
Bethlehem	200	G 7
Beverly Shores	488	C 1
Bicknell	4,572	C 7
Billingsville	35	H 5
Bippus	200	F 3
Birdseye	354	D 8
Blackhawk	100	C 6
Blackoak	6,000	C 1
Blaine	25	G 4
Blairville		B 8
Blanford	750	B 5
Blocher	250	F 7
Bloomfield	2,086	D 6
Blooming Grove	105	G 5
Bloomingdale	434	C 5
Bloomingport	60	G 5
Bloomington	28,163	D 6
Blountsville	229	G 4
Blue Ridge	100	F 5
Bluegrass	50	E 3
Bluffton	6,076	G 3
Boggstown	149	F 5
Bono	25	E 7
Boone Grove	170	C 2
Boonville	5,092	C 8
Borden	426	F 8
Boston	257	H 5
Boswell	963	C 3
Boundary	35	H 4
Bourbon	1,404	E 2
Bowers	25	D 4
Bowling Green	235	D 6
Boyleston	110	E 4
Bracken	9	F 3
Bradford	119	E 8
Branchville	75	D 8
Brazil	8,434	C 5
Bremen	2,664	E 2
Brems	112	D 2
Brewersville	62	F 6
Brice	12	H 4
Bridgeport	500	E 5
Bridgeton	350	C 5
Bright	275	H 6
Brighton	100	G 1
Brimfield	210	G 2
Brinckley		G 4
Bringhurst	253	E 3
Bristol	738	F 1
Bristow		D 8
Bromer	75	E 7
Bronson (Losantville)	247	G 4
Brook	915	C 3
Brooklyn	592	E 5
Brooksburg	132	G 7
Brookston	1,014	D 3
Brookville	2,538	G 6
Browns Corner	35	F 3
Browns Valley	125	D 5
Brownsburg	1,578	E 5
Brownstown	1,998	F 7
Brownsville	275	H 5
Bruceville	800	C 7
Brunswick	150	B 2
Brushy Prairie	100	G 1
Bryant	339	G 3
Bryantsburg	35	G 7
Buck Creek	279	D 4
Buckeye	25	G 3
Buckskin	250	C 8
Bud	10	E 6
Buena Vista		G 6
Buffalo	135	D 3
Buffaloville		D 8
Bullock	39	C 9
Bunker Hill	500	B 7
Bunker Hill	659	E 3
Burdick		D 1
Burket	217	F 2
Burlington	600	E 4
Burnettsville	457	D 3
Burney	232	F 6
Burns City	242	D 7
Burnsville		F 6
Burr Oak	120	E 2
Burrows	350	E 3
Butler	1,914	H 2
Butlerville	306	F 6
Byron	50	C 5
Caborn	50	B 9
Cadiz	222	G 5
Cale	60	D 7
Calvertsville	22	D 6
Cambria	70	D 4
Cambridge City	2,559	G 5
Camden	600	D 3
Cammack	200	G 4
Campbellsburg	637	E 7
Canaan	270	G 7
Cannelburg	128	C 7
Cannelton	2,027	D 9
Canton	125	E 7
Cape Sandy		E 8
Carbon	480	C 5
Carlisle	767	C 7
Carlos	120	G 4
Carmel	1,009	E 5
Carp	30	D 6
Carpentersville	80	D 5
Cartersburg	260	E 5
Carthage	1,065	F 5
Cass		C 6
Cassville	100	E 3
Castleton	268	E 5
Cataract	46	D 6
Cates	150	C 4
Catlin		C 5
Cato		C 8
Cayuga	1,022	C 5
Cedar Grove	193	H 6
Cedar Lake	3,907	C 2
Cedarville	220	G 2
Celestine	120	D 8
Centenary	200	B 5
Center	275	E 4
Center Square	55	H 7
Centerpoint	297	C 6
Centerton	125	E 5
Centerville	1,386	H 5
Central	40	E 8
Chalmers	508	D 3
Chambersburg	200	E 7
Chandler	1,050	C 8
Chapel Hill	6	E 6
Charlestown	4,785	F 8
Charlottesville	400	F 5
Chase	40	C 3
Chelsea	35	F 7
Cherry Grove	15	D 4
Chester	102	H 5
Chesterfield	1,086	F 4
Chesterton	3,175	D 1
Chili	115	F 3
Chrisney	439	C 8
Churubusco	1,232	G 2
Cicero	1,021	E 4
Clare	75	F 4
Clarks Hill	493	D 4
Clarksburg	325	G 6
Clarksville	117	F 5
Clarksville	5,905	F 8
Clay City	1,068	C 6
Claypool	416	F 2
Claysburg		F 8
Clayton	598	D 5
Clear Creek	450	E 6
Clear Lake	151	H 1
Clear Springs	205	E 7
Clermont	824	E 5
Clifford	232	F 6
Clifty	175	F 6
Clinton	6,462	C 5
Cloverdale	649	D 5
Cloverland	150	C 6
Clymers	150	E 3
Coal Bluff	128	C 5
Coal City	300	D 6
Coal Creek	75	C 4
Coalmont	595	C 6
Coatesville	444	D 5
Coe		C 8
Coesse	150	G 2
Colburn	234	D 3
Colfax	725	D 4
Collamer	50	F 2
Collegeville	600	C 3
Collett	30	H 4
Collins		G 2
Columbia City	4,745	G 2
Columbus	18,370	E 6
Commiskey	100	F 7
Concord		H 2
Connersville	15,550	G 5
Conroe		D 4
Converse	979	F 3
Cook	350	C 2
Cope	50	E 6
Corning	49	D 7
Correct	150	G 7
Cortland	102	F 7
Corunna	338	G 2
Cory	250	C 6
Corydon	1,944	E 8
Cosperville	45	F 1
Cottage Grove	100	H 5
Covington	2,235	C 4
Cowan	300	G 4
Coxville	56	C 5
Craigville		G 3
Crandall	149	E 8
Crane	21	D 4
Crane	2,000	D 7
Crawfordsville	12,851	D 4
Cresco		F 2
Creston	110	C 2
Crete	25	H 4
Crisman	300	C 1
Crocker	150	C 1
Cromwell	449	F 2
Crooked Creek		G 1
Cross Plains	150	G 7
Crothersville	1,276	F 7
Crown Center		D 5
Crown Point	5,839	C 2
Crows Nest	86	*E 5
Crumstown	200	E 1
Crystal	61	D 8
Cuba	17	D 6
Culver	1,563	E 2
Cumback	50	C 7
Cumberland	550	F 5
Curtisville	122	F 4
Cutler	165	D 4
Cuzco	55	D 8
Cyclone	70	E 4
Cynthiana	591	B 8
Cypress	15	B 9
Dabney	50	G 6
Dale	850	D 8
Daleville		F 4
Dana	854	C 5
Danville	2,802	D 5
Darlington	711	D 4
Daylight	35	B 8
Dayton	650	D 4
Decatur	7,271	H 3
Decker	386	B 7
Deedsville	150	E 3
Deer Creek	120	E 3
Deerfield	100	H 4
Delaware	229	G 6
Delong	120	E 2
Delphi	2,530	D 3
Demotte	700	C 2
Denham	150	D 2
Denver	528	E 3
Depauw	155	E 8
Deputy	250	F 7
Derby	73	D 8
Desoto	205	G 4
Dexter	1	E 8
Diamond		C 5
Dillman	30	G 3
Dillsboro	681	G 6
Disko	150	E 2
Doans	30	D 7
Dolan	24	E 6
Domestic	26	G 3
Donaldson		E 2
Doolittle Mills		D 8
Dora	80	F 3
Dover	100	H 6
Dover Hill	150	D 7
Downey's Corner	25	H 7
Dublin	993	G 5
Dubois	451	D 8
Dudleytown	65	F 7
Duff	68	C 8
Dugger	1,204	C 6
Dundee	56	F 4
Dune Acres	86	C 1
Dunfee	45	G 2
Dunkirk	3,048	G 4
Dunlap	1,154	F 1
Dunnington	20	C 3
Dunreith	196	G 5
Dupont		G 7
Durbin	24	F 4
Dyer	1,556	C 1
Eagletown	100	E 4
Earl Park	488	C 3
E. Chicago	54,263	C 1
E. Columbus		F 6
E. Enterprise	125	H 7
E. Gary	5,635	C 1
E. Germantown (Pershing)	389	G 5
Eaton	1,598	G 4
Eby	26	C 8
Eckerty	180	D 8
Economy	285	G 5
Eden	94	F 5
Edgerton	112	H 2
Edgewood	796	F 4
Edinburg	3,283	E 6
Edwardsport	850	C 7
Edwardsville	120	F 8
Effner	50	C 3
Ege	50	G 2
Ekin	50	E 4
Elberfeld	499	C 8
Elizabeth	211	F 8
Elizabethtown	323	F 6
Elizaville	51	E 4
Elkhart	35,556	F 1
Elkinsville	25	E 6
Ellettsville	855	D 6
Elmdale	75	D 4
Elnora	849	C 7
Elon		D 8
Elrod	66	G 6
Elston	40	D 4
Elwood	11,362	F 4
Eminence	175	D 5
Emison	90	C 7
Emma	50	F 1
Emporia	65	F 5
English	839	E 8
English Lake	148	D 2
Enochsburg	40	G 6
Enos	25	C 2
Epsom	125	C 7
Ethel	10	E 8
Etna		F 2
Etna Green	444	E 2
Eugene	350	B 5
Eureka	75	C 9
Evans Landing		F 8
Evanston	39	D 8
Evansville	128,636	C 9
Everton		G 5
Fair Oaks	200	C 2
Fairbanks		B 6
Fairland	750	F 5
Fairmount	2,646	F 4
Fairview	52	G 4
Fairview	54	G 7
Fairview Park	902	C 5
Falmouth	200	G 5
Farlen	7	D 7
Farmers Retreat	70	G 7
Farmersburg	1,024	C 6
Farmland	943	G 4

*No room on map for name.



CHICAGO
Lake Michigan
MICHIGAN
OHIO
Hammond
Gary
Michigan City
La Porte
South Bend
Mishawaka
Elkhart
Goshen
Valparaiso
Plymouth
Warsaw
Fort Wayne
Huntington
Wabash
Peru
Logansport
Kokomo
Marion
Muncie
Anderson
Lafayette
Frankfort
Crawfordsville
Danville
Champaign
Urbana
Joliet
Aurora
Hoopeston
Gilman
Sheldon
Van Wert
Paulding
Decatur
Portland
Bluffton
Tipton
Noblesville
New Castle
Rensselaer
Monticello
Winamac
Rochester
Kendallville
Auburn
Angola
Sturgis
Niles
Constantine
LAKE
PORTER
LA PORTE
ST. JOSEPH
ELKHART
LAGRANGE
STEUBEN
DE KALB
NOBLE
KOSCIUSKO
MARSHALL
STARKE
JASPER
NEWTON
PULASKI
FULTON
WHITLEY
ALLEN
WABASH
HUNTINGTON
WELLS
ADAMS
MIAMI
CASS
WHITE
CARROLL
BENTON
WARREN
TIPPECANOE
CLINTON
HOWARD
TIPTON
GRANT
BLACKFORD
JAY
DELAWARE
RANDOLPH
MADISON
HAMILTON
BOONE
MONTGOMERY
FOUNTAIN
HENRY
WAYNE



INDIANA
SCALE OF MILES
0 5 10 20 30 40
State Capitals
County Seats
Railroads
INDIANAPOLIS
CINCINNATI
LOUISVILLE
Terre Haute
Evansville
Bloomington
Columbus
Vincennes
Madison
Jeffersonville
New Albany
Covington
Henderson
Hamilton
Oxford
RIVER
OHIO
Kentucky R.
Wabash
Longitude West of Greenwich
88° 87° 86° 85°
39° 38°
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5591

Fayette	98	E 5
Fayetteville	50	D 7
Fenns	40	F 6
Ferdinand	1,252	D 8
Ferndale	15	C 5
Fiat	50	G 3
Fickle	10	D 4
Fillmore	375	D 5
Fincastle	75	D 5
Finly		F 5
Fishers	219	E 5
Fishersburg	130	F 4
Flat Rock	196	F 6
Flint	100	G 1
Flora	1,657	E 3
Florence		H 7
Florida	100	F 4
Floyds Knobs	455	F 8
Folsomville		C 8
Fontanet	540	C 5
Foraker	144	F 1
Foresman	90	C 3
Forest	400	E 4
Forest Hill	75	F 6
Fort Branch	1,944	B 8
Fort Ritner	150	E 7
Ft. Wayne	133,607	G 2
Fortville	1,786	F 5
Foster	25	C 4
Fountain	50	C 4
Fountain City	588	H 5
Fountaintown	250	F 5
Fowler	2,117	C 3
Fowlerton	292	F 4
Francesville	856	D 3
Francisco	606	B 8
Frankfort	15,028	E 4
Franklin	7,316	E 6
Frankton	1,047	F 4
Fredericksburg	211	E 8
Fredonia		E 8
Free	4	C 3
Freedom	175	D 6
Freeland Park	94	C 3
Freelandville	789	C 7
Freeman	28	D 6
Freeport	60	F 5
Freetown	500	E 7
Fremont	947	H 1
French	75	H 6
French Lick	1,946	D 7
Friendship	130	G 7
Friendswood	115	E 5
Fritchton	125	C 7
Fulda	100	D 8
Fulton	366	E 3
Galena	207	F 8
Galveston	905	E 3
Garrett	4,291	G 2
Gary	133,911	C 1
Gas City	3,787	F 4
Gaston	729	G 4
Gatchel	20	D 8
Geetingsville	25	D 4
Gem		F 5
Geneva	999	H 3
Gentryville	234	C 8
Georgetown	449	F 8
Georgia	10	D 7
Gerald		D 9
Gessie	115	C 4
Gifford	43	D 2
Gilead	75	E 3
Gilman	12	F 4
Gimco City	13	*F 4
Gings	45	G 5
Glendale	150	C 7
Glenn	75	C 6
Glenwood	412	G 5
Glezen	400	C 8
Glidas	10	E 8
Gnaw Bone	2	E 6
Goblesville	57	G 3
Goldsmith	242	E 4
Goodland	1,218	C 3
Goshen	13,003	F 1
Gosport	672	D 6
Grabill	370	H 2
Grafton	50	B 9
Grammer	125	F 6
Grand View	664	C 9
Granger	160	E 1
Grantsburg	90	E 8
Grasscreek	105	E 3
Gravelton	40	F 2
Graysville	100	B 6
Green Center	20	G 2
Green Hill	50	C 4
Green Oak	4	E 2
Greencastle	6,888	D 5
Greendale	2,018	H 6
Greenfield	6,159	F 5
Greenfield Mills	25	G 1
Greens Fork	413	H 5
Greensboro	241	G 5
Greensburg	6,599	G 6
Greentown	1,160	E 4
Greenville	298	F 8
Greenwood	3,066	E 5
Griffin	249	B 8
Griffith	4,470	C 1
Groveland	30	D 5
Grovertown	200	D 2
Groves		G 5
Guilford	300	H 6
Guion	14	C 5
Guthrie		D 7
Gwynneville	244	F 5
Hackleman	30	F 4
Hadley	50	D 5
Hagerstown	1,694	G 5
Hall	125	E 5
Hamilton	376	H 1
Hamlet	659	D 2
Hammond	87,594	B 1
Hancock	50	E 8
Hanna	450	D 2
Hanover	1,060	F 7
Hardinsburg	247	E 8
Harlan	500	H 2
Harmony	650	C 5
Harrisburg		G 5
Harrisville	83	H 4
Harrodsburg	400	D 6
Hartford City	7,253	G 4
Hartsville	340	F 6
Hastings	35	F 2
Hatfield		C 9
Haubstadt	894	B 8
Hayden	200	F 7
Haymond	20	G 6
Haysville	352	D 8
Hazelrigg	45	D 4
Hazelwood		D 5
Hazleton	498	B 8
Headlee	69	D 3
Heath	12	D 4
Hebron	1,010	C 2
Hedrick	68	C 4
Hellman	100	C 8
Helmer	110	G 1
Helmsburg	150	E 6
Heltonville	500	E 7
Hemlock	177	F 4
Henderson	68	F 5
Henryville		F 7
Herbst	250	F 3
Hibbard	100	E 2
Highland	5,878	B 1
Highwoods	40	*F 5
Hillham		D 7
Hillisburg	225	E 4
Hillsboro	526	C 4
Hillsdale	250	C 5
Hoagland	375	H 3
Hobart	10,244	C 1
Hobbieville	125	D 6
Hobbs	185	F 4
Holland	501	C 8
Hollandsburg	25	C 5
Holton	400	G 6
Home Corner (Vets. Adm. Hos.)	3,950	F 3
Home Croft	659	*E 5
Homer	150	F 5
Homestead		H 6
Honey Creek	125	F 4
Hoover	75	E 3
Hope	1,215	F 6
Hortonville	125	E 4
Houston	75	E 6
Howe	576	G 1
Howesville	75	C 6
Hudson	420	G 1
Hudsonville	76	C 7
Huntertown	500	G 2
Huntingburg	4,056	D 8
Huntington	15,079	G 3
Huntsville	50	G 4
Huntsville	265	F 4
Hurlburt	18	C 2
Huron		D 7
Hymera	1,069	C 6
Idaville	500	D 3
Independence	200	C 4
Indian Springs	115	D 7
Indian Village	57	E 1
INDIANAPOLIS	427,173	E 5
Ingalls	666	F 5
Inglefield	100	B 8
Inwood	178	E 2
Ireland	325	C 8
Jacksonburg	94	G 5
Jalapa	150	F 3
Jamestown	718	D 5
Jasonville	2,937	C 6
Jasper	5,215	D 8
Jefferson	90	D 4
Jeffersonville	14,685	F 8
Jessup	67	C 5
Jimtown	200	E 1
Johnson	250	B 8
Jolietville	125	E 4
Jonesboro	1,973	F 4
Jonesville	225	F 6
Judson	96	C 5
Judyville	90	C 4
Keller	25	C 6
Kempton	438	E 4
Kendallville	6,119	G 2
Kennard	485	G 5
Kenneth	40	E 3
Kent	123	F 7
Kentland	1,633	C 3
Kersey	100	C 2
Kewanna	680	E 2
Keystone	225	G 3
Kimmell	300	F 2
Kingman	509	C 5
Kingsbury	281	D 1
Kingsford Heights	1,104	D 2
Kingston	50	G 6
Kirklin	734	E 4
Kirkpatrick	60	D 4
Kirksville		D 6
Kitchel	60	H 5
Knightstown	2,486	F 5
Knightsville	678	C 5
Kniman	150	C 2
Knox	3,034	D 2
Kokomo	38,672	E 4
Koleen		D 7
Koontz Lake	1,200	D 2
Kossuth	50	E 7
Kouts	718	C 2
Kramer		C 4
Kurtz	225	E 7
Kyana		D 8
La Crosse	618	D 2
La Fontaine	627	F 3
La Porte	20,414	D 1
Laconia	82	E 8
Ladoga	912	D 5
Lafayette	35,568	D 4
Lagrange	1,892	F 1
Lagro	545	F 3
Lake Bruce	100	E 2
Lake Cicott	128	D 3
Lake James		H 1
Lake Village		C 2
Lakeland	2,172	D 1
Lakeside	10	D 3
Laketon		F 3
Lakeville	736	E 1
Lamar	99	D 8
Lamb	35	G 7
Lancaster	50	F 7
Landess	135	F 3
Lanesville	314	E 8
Laotto	264	G 2
Lapaz	512	E 2
Lapel	1,389	F 4
Larwill	316	F 2
Laud		G 2
Lauer		D 9
Laughery		H 7
Laurel	680	G 6
Lawrence	1,951	E 5
Lawrenceburg	4,806	H 6
Lawrenceport	125	D 7
Lawrenceville	50	H 6
Lawton	20	D 2
Leavenworth	358	E 8
Lebanon	7,631	D 4
Lee		D 3
Leesburg	428	F 2
Leesville	75	E 7
Leipsic	150	E 7
Leisure	20	F 4
Leiters Ford	250	E 2
Lena	75	C 5
Leo	385	G 2
Leopold	101	D 8
Leota	35	F 7
Leroy	350	C 2
Letts	208	F 6
Lewis	600	C 6
Lewis Creek	62	F 6
Lewisville	591	G 5
Lexington	350	F 7
Liberty	1,730	H 5
Liberty Ctr.	300	G 3
Liberty Mills	200	F 2
Ligonier	2,375	F 2
Limedale		D 5
Lincoln	130	E 3
Lincoln City		C 8
Lincolnville	200	F 3
Linden	590	D 4
Linngrove		H 3
Linnsburg	75	D 5
Linton	5,973	C 6
Linwood	72	F 4
Lisbon	67	G 2
Little York	146	F 7
Livonia	185	E 7
Lizton	276	D 5
Lochiel	38	C 3
Locust Point	18	F 8
Logan	125	H 6
Logansport	21,031	E 3
London	135	F 5
Long Beach	1,103	D 1
Loogootee	2,424	D 7
Lookout	16	G 6
Losantville	247	G 4
Lovett	52	F 7
Lowell	1,621	C 2
Lucerne	200	E 3
Luther	6	F 2
Lydick	1,175	E 1
Lyford	368	C 5
Lynhurst	160	*E 5
Lynn	1,149	H 4
Lynnville	404	C 8
Lyons	695	C 7
Mace	90	D 4
Mackey	170	C 8
Macy	288	E 3
Madison	7,506	G 7
Magley	50	G 3
Magnet	73	D 8
Mahalasville	75	E 6
Majenica	97	F 3
Malden	50	C 2
Manchester	3	H 6
Manhattan		D 5
Manilla	400	F 5
Mansfield	35	C 5
Manson	65	D 4
Maples	110	H 2
Marco	195	C 7
Marengo	801	E 8
Mariah Hill		D 8
Marietta	150	F 6
Marion	30,081	F 3
Markland	200	G 7
Markle	733	G 3
Markleville	314	F 5
Marshall	326	C 5
Marshfield	100	C 4
Martinsburg	125	E 8
Martinsville	5,991	D 6
Marysville	98	F 7
Matthews	501	F 4
Mauckport	154	E 8
Maumee	25	E 6
Maxinkuckee	75	E 2
Maxwell	285	F 5
Mays	200	G 5
Maywood	525	E 5
Mc Cool	250	C 1
Mc Cordsville	375	F 5
Mc Coysburg		C 3
Mc Grawsville	50	E 3
Mc Natts	25	G 3
Mecca		C 5
Mechanicsburg	250	G 5
Medaryville	833	D 2
Medora	627	E 7
Mellott	266	C 4
Memphis	380	F 8
Mentone	798	E 2
Meridian Hills	708	*E 5
Merom	374	B 6
Merriam	110	G 2
Merrillville	1,400	C 2
Metamora	400	G 6
Metea	45	E 3
Metz	175	H 1
Mexico	521	E 3
Miami		E 3
Michiana Shores	107	*D 1
Michigan City	28,395	C 1
Michigantown	443	E 4
Middlebury	839	F 1
Middlefork	62	E 4
Middletown	1,731	F 4
Midland		C 6
Midway	20	C 8
Mier	63	F 3
Milan	1,014	G 6
Milford	952	F 2
Milford (Clifty)	175	F 6
Mill Creek	162	D 1
Millersburg		C 8
Millersburg	437	F 1
Millgrove	160	G 4
Millhousen	184	G 6
Milligan	100	C 5
Milltown	760	E 8
Millville	120	G 5
Milo		G 3
Milroy	800	G 6
Milton	752	G 5
Mineral	55	D 7
Mishawaka	32,913	E 1
Mitchell	3,245	E 7
Modoc	275	G 4
Mohawk	150	F 5
Mongo	225	G 1
Monitor	50	D 4
Monmouth	100	H 3
Monon	1,439	D 3
Monroe	428	H 3
Monroe City	453	C 7
Monroeville	1,150	H 3
Monrovia	375	E 5
Monterey	250	D 2
Montezuma	1,223	C 5
Montgomery	538	C 7
Monticello	3,467	D 3
Montmorenci	235	D 4
Montpelier	1,826	G 3
Moody		C 3
Moore	30	H 2
Moorefield		G 7
Mooreland	497	G 5
Moores Hill	445	G 6
Mooresville	2,264	E 5
Moran	140	D 4
Morgantown	838	E 6
Morocco	1,141	C 3
Morris	500	G 6
Morristown	679	F 5
Morton		D 5
Moscow		F 6
Mt. Auburn	164	*G 5
Mt. Ayr	222	C 3
Mt. Carmel	134	H 6
Mt. Comfort	115	F 5
Mt. Etna	171	F 3
Mt. Meridian		D 5
Mt. Pisgah	54	G 1
Mt. Pleasant	24	D 8
Mt. Sterling	40	G 7
Mt. Summit	295	G 4
Mt. Vernon	6,150	B 9
Mt. Zion	30	G 3
Mulberry	950	D 4
Muncie	58,479	G 4
Munster	4,753	B 1
Murray	94	G 3
Nabb	110	F 7
Napoleon	350	G 6
Nappanee	3,393	F 2
Nashville	526	E 6
Nead	48	E 3
Nebraska	104	F 6
Needham	110	E 5
Needmore	150	E 7
Nevada	45	F 4
Nevada Mills	75	G 1
New Albany	29,436	F 8
New Amsterdam	76	E 8
New Augusta	225	E 5
New Bellsville	20	E 6
New Burlington	100	G 4
New Carlisle	983	E 1
New Castle	18,271	G 5
New Chicago	921	C 1
New Corydon	105	H 3
New Goshen	600	B 5
New Harmony	1,360	B 8
New Haven	2,336	H 2
New Holland	20	F 3
New Hope	11	D 6
New Lebanon	125	C 6
New Lisbon	290	G 5
New London	210	E 4
New Marion	150	G 6
New Market	370	D 5
New Middletown	153	E 8
New Mount Pleasant	100	G 4
New Palestine	504	F 5
New Paris	985	F 2
New Pekin	543	F 7
New Philadelphia		F 7
New Point	322	G 6
New Providence (Borden)	426	F 8
New Richmond	391	D 4
New Ross	336	D 5
New Salem	206	G 5
New Salisbury	215	E 8
New Trenton	150	H 6
New Washington	750	F 7
New Waverly	190	E 3
New Winchester	75	D 5
Newbern		F 6
Newberry	340	C 7
Newburgh	1,324	C 9
Newland		C 2
Newport	660	C 5
Newton Stewart	40	D 8
Newtonville	123	D 8
Newtown	287	C 4
Newville	75	H 2
Nineveh	300	E 6
Noblesville	6,567	F 4
Norman	110	E 7
Norristown	75	F 6
N. Crows Nest	46	*D 5
N. Grove	126	F 3
N. Hayden	150	B 2
N. Judson	1,705	D 2
N. Liberty	1,165	E 1
N. Madison	715	G 7

*No room on map for name.

N. Manchester	3,977	F 3
N. Salem	544	D 5
N. Terre Haute	700	C 5
N. Vernon	3,488	F 6
N. Webster	487	F 2
Norway		D 3
Notre Dame	5,000	E 1
Nulltown		G 5
Oak	150	D 3
Oak Forest	120	G 6
Oakford	230	E 4
Oakland City	3,539	C 8
Oaklandon	346	E 5
Oaktown	763	C 7
Oakville	224	G 4
Oatsville	100	C 8
Ober	100	D 2
Ockley	140	D 4
Odell	210	C 4
Odon	1,177	C 7
Ogden Dunes	429	C 1
Oldenburg	591	G 6
Olean	225	G 7
Oliver		B 8
Omega	50	F 4
Ontario	150	G 1
Onward	140	E 3
Oolitic	1,125	E 7
Ora	140	D 2
Orange	200	G 5
Orangeville	85	D 7
Orestes	482	F 4
Orland	386	G 1
Orleans	1,531	D 7
Osceola	1,091	E 1
Osgood	1,228	G 6
Ossian	761	G 3
Oswego		F 2
Otis		D 1
Otisco	250	F 7
Otterbein	641	C 4
Otto		G 7
Otwell	400	C 8
Owensburg	400	D 7
Owensville	1,110	B 8
Oxford	888	C 3
Packertown	72	F 2
Palestine	90	F 2
Palmer	200	C 2
Palmyra	327	E 8
Paoli	2,575	E 7
Paragon	463	D 6
Paris Crossing	132	F 7
Parker	915	G 4
Parkersburg	100	D 5
Parr	132	C 2
Patoka	626	B 8
Patricksburg	450	D 6
Patriot	315	H 7
Patronville	30	C 9
Paxton	275	C 6
Paynesville	50	F 7
Peabody		G 2
Pekin	553	E 7
Pelzer	49	C 8
Pence	122	C 4
Pendleton	2,082	F 5
Pennville	626	G 4
Peoga	48	E 6
Percy Junction	4	C 3
Perkinsville	250	F 4
Perrysburg	50	E 3
Perrysville	462	C 4
Pershing	389	G 5
Pershing	50	E 2
Peru	13,308	E 3
Petersburg	3,035	C 7
Peterson	50	G 3
Petersville		F 6
Petroleum		G 3
Phenix		G 3
Pickard		E 4
Pierceton	973	F 2
Pierceville		G 6
Pikes Peak		E 6
Pikeville	50	C 8
Pilot Knob	200	E 8
Pimento	125	C 6
Pine Village	311	C 4
Pinelake	250	D 1
Pinola	50	D 1
Pittsboro	599	D 5
Pittsburg	350	D 3
Plainfield	2,585	E 5
Plainville	568	C 7
Plato	40	G 1
Pleasant	15	G 7
Pleasant Lake	500	H 1
Pleasant Mills	175	H 3
Pleasant Ridge		C 3
Pleasant View	11	F 5
Pleasantville	200	C 7
Plevna	72	E 3
Plum Tree	40	G 3
Plummer	10	C 7
Plymouth	6,704	E 2

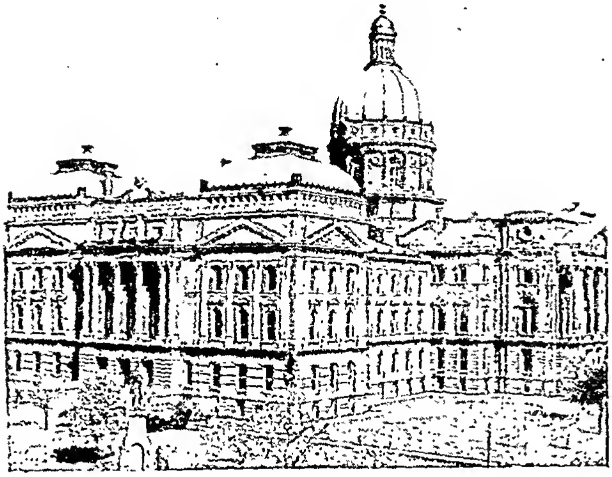
Poe	80	G 3
Point Isabel	75	F 4
Poland	150	C 6
Poneto	244	G 3
Porter	1,458	C 1
Portersville	75	C 8
Portland	7,064	H 4
Poseyville	1,005	B 8
Pottawattomie Park	35	D 1
Powers	50	G 4
Prairie Creek	225	C 6
Prairieton	315	B 6
Preble	150	H 3
Prescott	30	F 6
Priam		G 4
Princeton	7,673	B 8
Providence	100	E 6
Pulaski	100	D 3
Putnamville	165	D 5
Pyrmont	100	D 4
Queensville	70	F 6
Quincy	320	D 6
Raber		G 2
Raccoon	100	D 5
Radley	150	F 4
Radnor	110	D 3
Ragsdale	230	C 7
Rainsville	130	C 4
Raleigh	150	G 5
Ramsey	106	E 8
Ranger		D 8
Raub	110	C 3
Ravenswood	498	E 5
Ray	175	H 1
Raymond	62	H 6
Rays Crossing	75	F 5
Reagan	2	D 4
Red Key	1,639	G 4
Redbridge	75	F 3
Reddington	220	F 6
Reelsville	90	D 5
Reese Mill	130	D 4
Reiffsburg	43	G 3
Remington	1,053	C 3
Rensselaer	4,072	C 3
Rexville	60	G 7
Reynolds	499	D 3
Riceville	4	D 8
Richland	530	C 9
Richland Center	10	E 2
Richmond	39,539	H 5
Richvalley	111	F 3
Ridgeview		E 3
Ridgeville	950	G 4
Rigdon	80	F 4
Riley	251	C 6
Rileysburg	40	B 4
Rising Sun	1,930	H 7
River	75	G 3
Riverside	120	C 4
Riverton	54	B 6
Roachdale	918	D 5
Roann	492	F 3
Roanoke	905	G 3
Rob Roy	54	C 4
Rochester	4,673	E 2
Rock Creek		G 3
Rockfield	325	D 3
Rocklane		E 5
Rockport	2,493	C 9
Rockville	2,467	C 5
Rocky Ripple	528	E 5
Roll	150	G 3
Rolling Prairie	625	D 1
Rome		D 9
Rome City	1,303	G 1
Romney	500	D 4
Rosedale	673	C 5
Roseland	984	E 1
Roselawn		C 2
Rosston	35	E 4
Rossville	739	D 4
Royal Center	876	E 3
Royalton	50	E 5
Royerton	400	G 4
Rumble	21	C 8
Rushville	6,761	G 5
Rusk		D 7
Russellville	361	D 5
Russiaville	1,025	E 4
St. Anthony	152	D 8
St. Bernice	1,200	C 5
St. Croix	100	D 8
St. Henry	183	D 8
St. Joe	479	H 2
St. John	684	C 2
St. Joseph Hill	200	F 8
St. Leon	288	H 6
St. Louis Crossing	150	F 6
St. Mary-of-the Woods	1,300	B 6
St. Mary's	1,000	E 1
St. Maurice	60	G 6
St. Meinrad	720	D 8
St. Omer	75	F 6
St. Paul	669	F 6

St. Peters	130	H 6
St. Philip	200	B 9
St. Wendells		B 8
Salamonia	181	H 4
Salem	3,271	E 7
Salem Center	50	G 1
Saline City	115	C 6
Saltillo	122	E 7
Samaria	88	E 6
San Pierre	350	D 2
Sandborn	572	C 7
Sanders	200	E 6
Sandford	195	B 5
Sandusky	200	G 6
Santa Claus	45	D 8
Santa Fe	92	E 3
Saratoga	333	H 4
Sardinia	150	F 6
Savah	100	B 8
Schererville	1,457	C 2
Schneider	356	C 2
Schnellville	300	D 8
Scipio	75	H 6
Scipio	200	F 6
Scircleville	181	E 4
Scotland	100	D 7
Scott	100	F 1
Scottsburg	2,953	F 7
Sedalia	180	E 4
Sedan	30	G 2
Seelyville	898	C 6
Sellersburg	1,664	F 8
Selma	499	G 4
Selvin		C 8
Servia	143	F 3
Sevastopol	50	F 2
Sexton	80	G 5
Seybert	30	F 1
Seymour	9,629	F 7
Shadeland	78	C 4
Shannondale	20	D 4
Sharpsville	508	E 4
Shelburn	1,412	C 6
Shelby	519	C 2
Shelbyville	11,734	F 6
Shepardsville	300	B 5
Sheridan	1,965	E 4
Shideler		G 4
Shipshewana	277	F 1
Shirley	1,087	F 5
Shirley City (Woodburn)	540	H 2
Shoals	1,039	D 7
Shooters Hill	13	*E 5
Shore Acres	9	*D 5
Shrock		F 1
Siberia	50	D 8
Sidney	168	F 2
Silver Lake	472	F 2
Silverville	60	D 7
Silverwood	75	C 5
Simpson	9	G 3
Sims	231	F 3
Skelton	50	B 8
Smartsburg	55	D 4
Smith Valley	150	E 5
Smithville	425	D 6
Snow Hill	15	H 4
Solon	137	F 7
Solsberry	500	D 6
Somerset	255	F 3
Somerville	353	C 8
S. Bend	115,911	E 1
S. Boston	125	F 7
S. Milford	350	G 1
S. Raub	30	D 4
S. Wanatah	95	D 2
S. Whitley	1,299	F 2
Southport	730	E 5
Spades		G 6
Sparksville	136	E 7
Spartanburg	200	H 4
Spearsville	38	E 6
Speed	1,000	F 8
Speedway	5,498	E 5
Speicher	60	F 3
Spelterville	150	C 5
Spencer	2,394	D 6
Spencerville	450	G 2
Spiceland	739	F 5
Spraytown	63	E 6
Spring Grove	333	H 5
Spring Hills	27	*E 5
Spring Lake Park	156	F 5
Springfield		B 8
Springport	217	G 4
Springville	500	D 7
Spurgeon	327	C 8
Stacer		B 8
Stanford	100	D 6
Star City	600	D 3
Starlight	50	F 8
State Line	152	C 4
Staunton	487	C 6
Steele	26	H 3
Stendal	175	C 8
Stewartsville	240	B 8

Stilesville	330	D 5
Stillwell	355	D 1
Stinesville		D 6
Stockwell	632	D 4
Stone	10	G 4
Stonebluff	172	C 4
Stones Crossing	75	E 5
Story		E 6
Straughn	345	G 5
Stroh	475	G 1
Strouse		G 2
Sullivan	5,423	C 6
Sulphur	43	E 8
Sulphur Springs	351	G 4
Sumava Resorts	125	C 2
Summit	2	G 1
Summitville	1,061	F 4
Sunman	358	G 6
Surprise	55	E 7
Swanington	125	C 3
Swayzee	690	F 4
Sweetsers	535	F 3
Switz City	328	C 6
Sycamore	76	F 4
Sylvania	35	C 5
Syracuse	1,453	F 2
Tab		C 4
Talbot		C 3
Talma	150	E 2
Tampico	150	F 7
Tangier	100	C 5
Taswell	110	D 8
Taylorsville	290	F 6
Tecumseh		C 8
Teegarden		E 2
Tefft	140	D 2
Tell City	5,735	D 9
Templeton	143	C 3
Tennyson	409	C 8
Terhune	100	E 4
Terre Haute	64,214	C 6
Thayer	250	C 2
Thorntown	1,380	D 4
Tiosa	125	E 2
Tippecanoe	400	E 2
Tipton	5,633	E 4
Tobinsport	205	D 9
Tocsin	175	G 3
Topeka	557	F 1
Toto	275	D 2
Tower		E 8
Trafalgar	439	E 6
Trail Creek	817	D 1
Treaty	90	F 3
Trevlac	48	E 6
Trinity Spgs.	150	D 7
Troy	537	D 9
Tulip	20	D 6
Tunker	40	F 2
Tunnelton	300	E 7
Twelve Mile	247	E 3
Tyner	250	E 2
Ulen	83	E 4
Underwood	328	F 7
Union	209	C 8
Union City	3,572	H 4
Union Mills	450	D 2
Uniondale	293	G 3
Unionport	50	G 4
Uniontown		D 8
Unionville	475	E 6
Universal	479	C 5
Upland	1,565	F 4
Urbana	400	F 3
Utica	250	F 8
Valeene	94	E 8
Valentine	110	G 1
Vallonia	510	E 7
Valparaiso	12,028	C 2
Van Buren	815	F 3
Veedersburg	1,719	C 4
Velpen	197	C 8
Vera Cruz	143	G 3
Verne	50	C 7
Vernon	480	F 7
Versailles	886	G 6
Veterans Adm. Hospital	3,950	F 3
Vevay	1,309	G 7
Vicksburg	390	C 6
Vienna	80	F 7
Vincennes	18,831	C 7
Vine	15	C 4
Virgie		C 2
Vistula	100	F 1
Wabash	10,621	F 3
Wadena	65	C 3
Wadesville		B 8
Wakarusa	1,143	F 1
Wakefield	45	F 7
Waldron	700	F 6
Walesboro		F 6
Walkerton	2,102	E 2
Wallace	123	C 5
Wallace Junction		D 6
Wallen	120	G 2

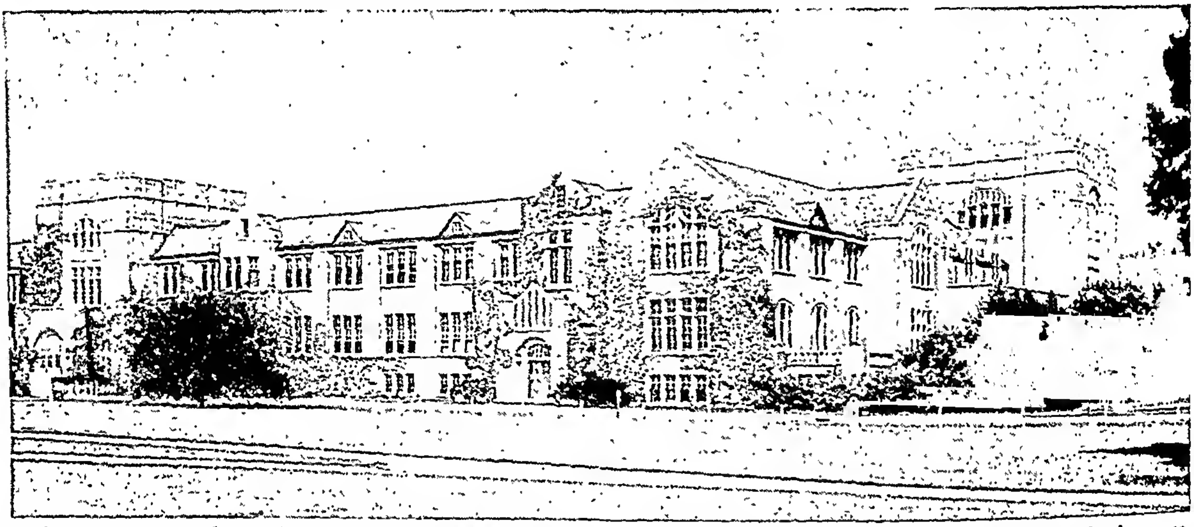
Walton	837	E 3
Wanamaker	325	E 5
Wanatah	750	D 2
Warren	1,247	G 3
Warren Park	336	F 5
Warrenton	100	B 8
Warrington	95	F 5
Warsaw	6,625	F 2
Washington	10,987	C 7
Waterloo	1,414	G 2
Waterman	100	C 5
Watson	200	F 8
Waveland	553	D 5
Waverly	150	E 5
Wawaka	300	F 2
Wawasee	400	F 2
Wawpecong	84	F 3
Waymansville	250	E 6
Waynedale	4,800	G 3
Waynesville		F 6
Waynetown	658	C 4
Webster	175	H 5
Weisburg	148	H 6
Wellsboro	170	D 1
West Baden Springs	1,047	D 7
W. College Corner	513	H 5
W. Fork	58	D 8
W. Franklin	100	B 9
W. Harrison	308	H 6
W. Lafayette	11,873	D 4
W. Lebanon	642	C 4
W. Middleton	250	E 4
W. Newton		E 5
W. Terre Haute	3,357	B 6
Westchester	8	H 4
Westfield	849	E 4
Westphalia	250	C 7
Westpoint	315	C 4
Westport	658	F 6
Westville	624	D 1
Wheatfield	496	C 2
Wheatland	735	C 7
Wheeler	400	C 1
Wheeling		G 4
Wheeling	50	C 8
Whitaker	25	D 6
Whitcomb	150	H 6
White Cloud	50	E 8
White Lick		E 5
Whitehall	80	D 6
Whiteland	465	E 5
Whitestown	550	E 5
Whitesville	75	D 5
Whitewater	104	H 5
Whiting	9,669	C 1
Wickliffe	9	D 8
Wilbur	75	D 5
Wilfred	50	C 6
Wilkinson	365	F 5
Williams	400	D 7
Williams	75	H 3
Williams Creek	288	E 5
Williamsport	1,241	C 4
Willow Branch		F 5
Wilmington	200	H 6
Wilmot	100	F 2
Wilson	25	F 6
Winamac	2,166	D 2
Winchester	5,467	G 4
Windfall	963	F 4
Windom	8	D 7
Windsor		G 4
Wingate	400	C 4
Winona L.	1,366	F 2
Winslow	1,322	C 8
Wirt		G 7
Wolcott	778	C 3
Wolcottville	672	G 1
Wolflake	250	F 2
Woodburn	540	H 2
Woodland	115	E 1
Woodlawn Hts.		F 4
Woodruff Place	1,557	E 5
Woodstock	29	*E 5
Worthington	1,627	C 6
Wyandotte	50	E 8
Wyatt	250	E 1
Wynnedale	75	*E 5
Yankeetown	323	C 9
Yeddo	115	C 4
Yeoman	180	D 3
Yoder	200	G 3
Yorktown	1,109	G 4
Yorkville	87	H 6
Young America	250	E 3
Youngs Creek	79	D 8
Youngstown	72	C 6
Zanesville	300	G 3
Zenas	44	G 6
Zionsville	1,536	E 5
Zipp		B 8
Zoar	5	C 8
Zulu	175	H 2

*No room on map for name.

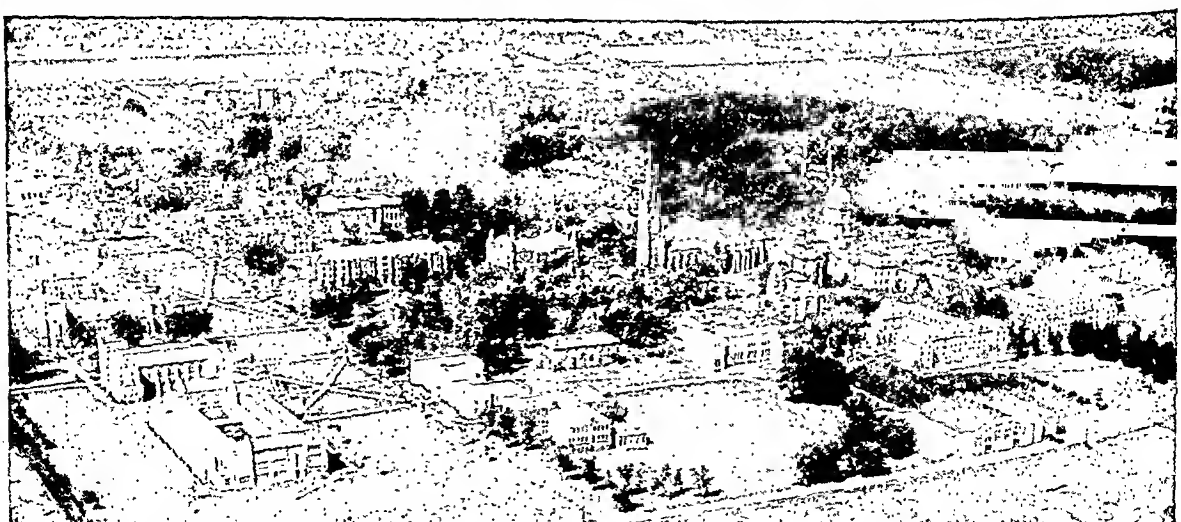


In almost the exact center of Indiana is Indianapolis, the state capital. The impressive Capitol Building is constructed of native Indiana limestone for which the state is famous.

At Bloomington is Indiana University. It is the state's largest institution of higher education. Its imposing Memorial Union Building is of the English-Gothic style of architecture.



Social center of Purdue University at West Lafayette is the attractive red brick and white stone Memorial Union Building. The school is named for John Purdue, a Lafayette businessman, who donated funds and land to establish it at its present site.



This Fairchild Surveys air view shows the University of Notre Dame at South Bend. It is one of the nation's leading Catholic universities. The dome marks the Administration Building; and the spire, the Church of Our Lady of the Sacred Heart.

feated and the splendid dream of his great brother Tecumseh was shattered, remains memorable today.

The lower Wabash, the lower White, and the Ohio rivers were highways for early commerce. From 1820 to 1840 nine tenths of the surplus produce of Indiana was shipped by flatboat down these rivers to the Mississippi and then to New Orleans. Today the only waterways in use are Lake Michigan and to some extent the Ohio River, the lower Wabash, and a small part of the White (*see* Ohio River; Wabash River).

Congress authorized the United States in 1954 to join Canada in the St. Lawrence Seaway Project. Indiana's Lake Michigan ports of Gary and Michigan City may become ocean ports.

The rivers of the state are not used much for water power. The water supply of the streams has become irregular since the great forests have been cut.

In 1954 work began on a toll expressway in the northern part of the state to extend between the Ohio border and the Illinois line.

Reclaiming Wasted Forest Lands

When the first settlers came, some seven eighths of Indiana was covered with dense hardwood forests. There were oak, walnut, beech, ash, maple, and the giant sycamore. These huge forests were a barrier to the pioneers. They had to be felled to make way for crops. They were a dangerous refuge for Indians and wild animals. Most of the trees were not used for fuel or lumber but were simply cut and burned.

The stout Hoosier pioneers, snatching at every opportunity to sweeten toil and hardship with fun and frolic, made the "logrolling" a community festival. The 20 to 50 men of a neighborhood would gather at one of the homes early in the day with axes. They would divide into two squads and make a game of seeing which side could outdo the other in piling logs for burning. In the log cabin their women folk were busy quilting and preparing the feast of venison, roast turkey, fried chicken, hog, hominy, potatoes, cornbread, biscuit, gingerbread, pies, preserves, milk, and cider. In the evening the young people would have energy left for dancing and games, while a hundred flaring log bonfires lit the sky. Each settler received the same help from his neighbors, so the festivity was repeated many times during the season, usually April or May.

The logrolling was an excellent opportunity for political candidates to win votes. A canny farmer could profit from the enthusiastic labor of rival candidates by postponing his logrolling until campaign time. "Logrolling" remains in our political vocabulary as a term for barter of favors.

Besides destroying valuable timberlands, the energetic pioneers also thoughtlessly brought on drought, soil erosion, and floods. The trees helped store moisture in the ground to be used by plants during scanty rainfall. With the spongy tree cover removed, heavy rains washed away rich topsoil. The streams and rivers often swelled to flood proportions. As a result, at least 100,000 acres in the southern part of the state are badly eroded.

BEAUTY IN FOREST AND DUNES

Quiet trails and scenic drives have opened to tourists the wilderness of Brown County, 40 miles south of Indianapolis. This inviting region of wooded hills and narrow valleys gave rise to an artists' colony in Nashville. Brown County State Park is the largest in Indiana, covering about 18,000 acres.

Around the southern end of Lake Michigan in Illinois, Indiana, and Michigan stretch these picturesque sand dunes. Along the entire 300-mile strip roll high, rugged hills of shifting sand, some covered with semidesert vegetation, some barren. Here Indiana Dunes State Park attracts thousands of visitors.

Hardwood timber is still a valuable natural resource. The remaining first-growth and young trees are of high quality. The State Department of Conservation operates nurseries for reforestation, promotes forest-fire prevention, and maintains 14 state forests, totaling about 100,000 acres. Hoosier National Forest in the south covers about 781,000 acres.

A Leading Industrial State

Since the turn of the century manufacturing in Indiana has steadily increased. Before the second World War the total value added to its manufactured goods each year was about 970 million dollars. By 1947 this figure had more than tripled, and Indiana had become one of the most important industrial states in the nation.

Today manufacturing employs more people than any other occupation. The total value added to manufactured goods is many times the total farm income. The largest industry is the manufacture of steel. Other important products include automobiles, railroad cars, machinery, electrical equipment, and processed foods.

Two natural conditions favor Indiana manufacturing. First are its mineral resources, particularly coal. Secondly, it is on the path of east-and-west travel, touching Lake Michigan. To these two factors it owes the remarkable growth of the Calumet district along the lake at the northwest border. Here Pennsylvania coke, Indiana and Illinois coal, Indiana limestone, and Lake Superior iron ore are easily brought together. The industrial cities in this region—Gary, Hammond, East Chicago, and Whiting—form one of the great manufacturing centers of the world. Part of the vast Chicago industrial area, the district shares the unrivaled railroad facilities of its big neighbor.

Gary, the largest of the Calumet cities, is the world's largest steel-producing center. From a sandy wasteland at the foot of Lake Michigan it grew into a city of more than 100,000 people in only 25 years (*see* Gary). The second largest city in this district is Hammond. Incorporated in 1884, it is the oldest city of the Calumet area. Next in size is East Chicago, a city of blast furnaces, rolling mills, oil refineries, and railroad shops. Whiting, the smallest of the Calumet cities, is the home of one of the largest oil refineries in the world.

Other Cities of the "Hoosier State"

Indianapolis, the state capital in the center of the state, is Indiana's largest city and an important manufacturing center. It is also a leading corn, grain, and livestock market. Railroads radiate from the city in all directions (*see* Indianapolis).

Fort Wayne, in the northeast, is a trade center and the shipping point for a rich agricultural district. Its busy factories make machinery and many other products (*see* Fort Wayne). In the far north, where the St. Joseph River bends toward Lake Michigan, lies South Bend. It is an industrial center surrounded by a farm, fruit, and dairy area. The city is the seat of the University of Notre Dame (*see* South Bend).

Evansville, on the Ohio River, is the largest metropolis of southern Indiana within a 100-mile radius. An industrial city, it is the world's largest manufacturer of refrigeration equipment (*see* Evansville). Terre Haute, meaning "high land," is primarily a coal town and railroad hub on the Wabash River. Muncie, on the White River, was once the home of the Munsee, a tribe of Delaware Indians. It is notable for its fine residential neighborhoods and the variety of its industries. Anderson, on the White River, lies in a rich farm section. It is also a large producer of automobile parts. Near the middle of the Indiana-Ohio border is Richmond. Now an industrial city, it was one of the first Quaker communities in Indiana.

Minerals That Built Industries

Natural gas, first produced commercially at Portland in 1886, did much to develop the industries of Anderson, Elwood, Fort Wayne, Muncie, and other towns. When this cheap fuel supply diminished, soft coal from the southwestern part of the state took its place. There are about 40 billion tons of Indiana coal reserves. Petroleum in commercial quantities was discovered in the Indiana portion of the Lima-Indiana field a few years after natural gas. Oil production has dwindled, and the great refineries at Whiting, East Chicago, and Hammond now operate chiefly on oil carried in by pipelines from the Mid-Continent field.

Among other native mineral products contributing to Indiana manufactures are marl and clay, used particularly in making portland cement; building, foundry, and glass sands, the last named used at Muncie, Kokomo, and Terre Haute in glass manufacture; kaolin and other clays and shales, used at Terre Haute in pottery; and limestone, used both for making lime and for building stone. The oölitic stone known as Bedford or Indiana limestone is highly prized. Around the mineral springs, chiefly in the southern part of the state, have grown up watering places such as French Lick and West Baden.

How the State Was Settled

Despite the advantages for industrial growth in the north this region was not settled until long after the southern portion had become comparatively well populated. Until the Cumberland Road (National Pike) was opened in 1834, from Cumberland, Md., to Indianapolis, there was no avenue of approach for the north comparable to that afforded by the Ohio River and lower Wabash for the south. About the same time the Michigan Road was constructed across the state from Lake Michigan to the Ohio—from the site of Michigan City through Indianapolis to Madison.

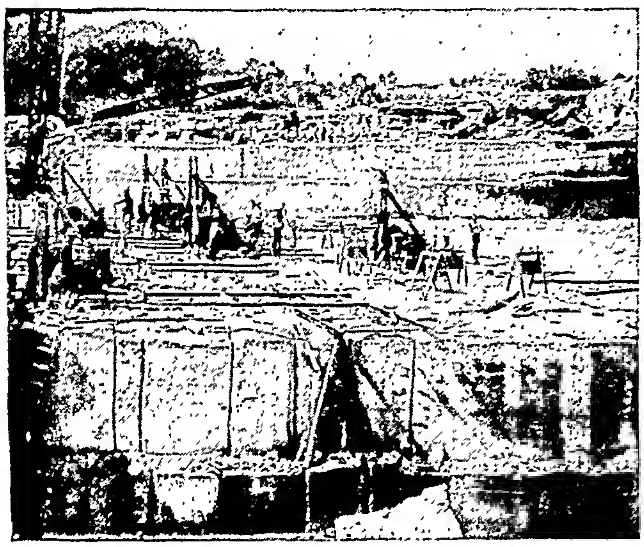
The rapid development of Chicago after 1833 helped attract more settlers to northern Indiana. Lake traffic became increasingly important. When railroads penetrated the region during the 1850's a wave of pioneers swept over northern Indiana. Most of these settlers came from New England, New Jersey, New York, and Ohio.

Indiana's Colleges and Notable Persons

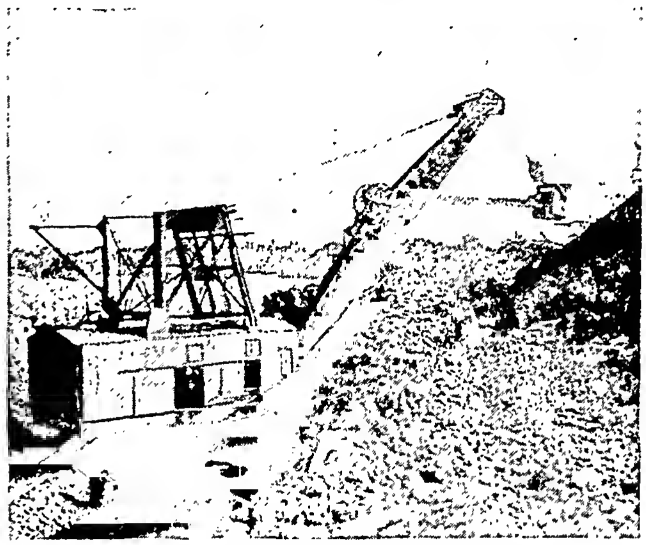
Indiana has more than 30 colleges and universities. Indiana University, at Bloomington and Indianapolis, includes the state schools of arts and sciences,

WORKADAY SCENES IN HOOSIERLAND

While agriculture is important, Indiana is primarily an industrial state. The men and machines at left are making gears for automobiles, trucks, and tractors. The workmen on the assembly line at right are constructing prefabricated houses.

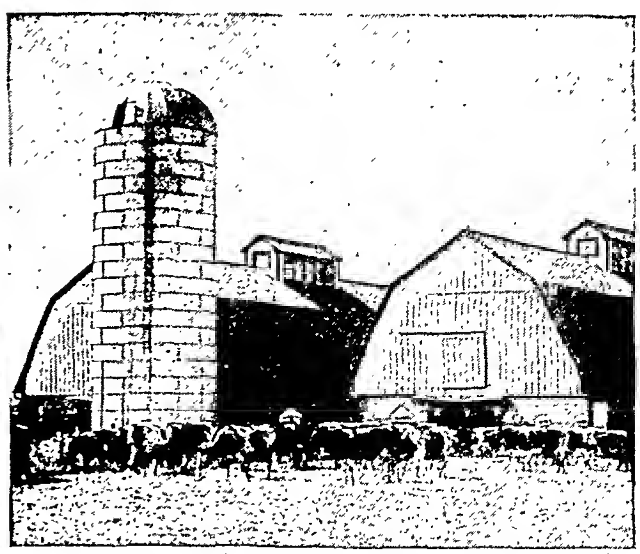


Limestone of the finest quality is cut out of the earth in great blocks to be shipped to all parts of the United States.



Coal is Indiana's most important mineral. This mammoth shovel is scooping coal from a strip mine in Clay County.

Judging these fine, heavy Berkshire hogs at the state fair is serious business for young and old. Indiana is one of the leaders among the states in the production of hogs.



This prosperous looking dairy farm is near Boonville. Grazing near the stainless steel silo and the twin barns is a Holstein herd. Milk and cattle are leading farm products.

law, medicine, education, and commerce. Purdue University, at West Lafayette, comprises the state schools of agriculture, science, engineering, pharmacy, and home economics. There are two teachers colleges.

The Hoosier is a natural storyteller, and the homespun literary tradition of Indiana is a heritage from pioneer times. Edward Eggleston's 'The Hoosier Schoolmaster' was one of the earliest attempts to picture the raw frontier life of this country in fiction. Some Indiana writers, such as that "Hoosier Arab," Lew Wallace, have gone abroad for inspiration, but others glory in being "provincial." James Whitcomb Riley was by common consent the state's poet laureate. American literature is also indebted to Indiana for Booth Tarkington, George Ade, Meredith Nicholson, Gene Stratton Porter, William Vaughn Moody, Albert J. Beveridge, Elmer Davis, Theodore Dreiser, George Barr McCutcheon, Annie Fellows Johnston, Claude G. Bowers, Joaquin Miller, David Graham Phillips, and other notables. To art, Indiana has contributed William Merritt Chase and the cartoonists "Kin" Hubbard and John T. McCutcheon.

Indiana's history is starred with notable names. Abraham Lincoln spent his youth there, near the Ohio River. President Benjamin Harrison was a "gentleman from Indiana," as were vice-presidents Schuyler Colfax, Thomas A. Hendricks, Charles W. Fairbanks, and Thomas R. Marshall. The noted engineer, James B. Eads; the Studebakers, known first for their wagons and then for their automobiles; James Oliver, a famous plowmaker; the philanthropists Chauncey Rose and Washington De Pauw (for whom De Pauw University was named); and Hugh McCulloch, a secretary of the treasury, are all in Indiana's Hall of Fame.

Indiana's History Begins with French Exploration

French Canadian or half-breed trappers and hunters —*coureurs de bois*—early ranged the Indiana woods. La Salle may have descended the Ohio in 1669. It is known that ten years later he explored the region. Then for 50 years only fur traders and Jesuit missionaries shared these forest solitudes with the Indian tribes—the Miami, Kickapoo, Piankishaw, Munsee, Delaware, Wyandotte, Shawnee, and Potawatomi. The French were satisfied to claim the land for France, control the fur trade, and try to Christianize the Indians. Shortly before the middle of the 18th century the French settled at Fort Vincennes.

The Wabash country was seized by the English in 1760, following the fall of Quebec. It was won for America during the Revolution when Col. George Rogers Clark and his Virginia riflemen forced the surrender of the British commander of the Northwest area at Fort Sackville in Vincennes in 1779. It later became part of the Northwest Territory (*see* Clark, George Rogers). Settlers were at first kept out by fear of the hostile Indians. General Anthony Wayne scored his notable victory over the Indians at Fallen Timbers in 1794, but after the determining of new boundary lines for Indiana Territory in 1809 (*see* Northwest Territory), the Indians resumed their attacks. They were utterly defeated by forces under Gov. William Henry Harrison, later president of the United States, in the famous battle of Tippecanoe, near Lafayette. (*See also* Harrison, William Henry; Tecumseh.)

Indiana became a part of the Union Dec. 11, 1816. At first the seat of government was at Corydon, but in 1825 it was moved to Indianapolis. After the final clearing of Indian title by the "New Purchase" of 1818, the state advanced rapidly. Between 1816 and 1830, the population increased from about 65,000 to nearly 350,000.

George Rapp (1757–1847) and his German followers in 1815 started a prosperous communistic colony, called New Harmony, on the Wabash. The colony sold out to Robert Owen, English socialist, in 1825. Brilliant scientists worked in Owen's settlement, among them Thomas Say, "father of American zoology"; Charles A. Lesueur, French naturalist; William McClure, "father of American geology"; and the geologist David Dale Owen. Quarrels ended the communistic experiment, but New Harmony remained a center of culture.

Between 1828 and about 1838, the state was "delirious with the fever for internal improvements." Roads, when properly constructed, remained a permanent gain, but the many canals built proved a failure, and the program left the state bankrupt.

Led by a great war governor, Oliver P. Morton, Indiana fought spiritedly for the Union in the Civil War. Confederates under Gen. John Hunt Morgan raided part of the state in 1863 but were captured.

Indiana's second constitution has been in effect since 1851. The governor is elected for a four-year term and the senate and house of representatives of the legislature meet biennially. (*See also* chronology and government section in Indiana Fact Summary.)

The origin of the state's nickname, "Hoosier," is uncertain. One explanation is that pioneers often used the expression "Who's yere?" (Who is here?), shortened by pronunciation to Hoosier. (*See also* United States, section "North Central Plains.")

INDIANAPOLIS, IND. The symmetry and much of the beauty of Indianapolis arise from the fact that it is a "made-to-order" city. In 1820, four years after Indiana had been admitted to the Union and two years after the title to this region was purchased from the Indians, the state legislature determined to plant the capital in the exact geographical center of the state. Choosing a site on the west fork of the White River, they cleared the trees away, made a circular central plaza with four diagonal avenues radiating from it, and laid the other streets in the usual checkerboard. Later the trees so ruthlessly destroyed were abundantly replaced.

Aside from its central location, Indianapolis has no great natural advantages, for the White River is not navigable at this point, but the early enterprise and the prosperity of its citizens soon attracted railway builders. The first line reached the city in 1847, and others followed rapidly. Now 16 railway lines of six railroads serve the city, making it the largest

city of Indiana and one of the most important commercial and industrial centers of the Middle West.

The Indiana World War Memorial Plaza contains the national headquarters of the American Legion, a mall, Obelisk Square where a 100-foot black obelisk rises from a fountain, and a main shrine building. Other notable public buildings are the State House and the County Court House, both built of the famous Indiana oōlite limestone and symmetrically placed at equal distances from the central plaza, called Monument Place. In this central plaza, where the Governor's Mansion once stood, is the beautiful Soldiers' and Sailors' Monument, 285 feet high, counting the 38-foot bronze statue of Victory at its top. The fountains at the base have a capacity of 18,000 gallons a minute and are among the largest in the world.

The city has many cultural advantages, including a fine symphony orchestra. The Indianapolis Children's Museum and the John Herron Art Museum and Art School are both outstanding. Among colleges in the city are Butler University, Indianapolis campus of Indiana University, Indiana Central College, and Marian College. The Arthur Jordan Conservatory of Music is also located here.

Among other well-known points of interest are the Indiana State Fair Grounds and the Municipal Airport, 6½ miles west of the city. The 2½-mile motor speedway is famous for its 500-mile race, held annually on Memorial Day since 1911 except during the first and second World Wars.

Indianapolis is a large meat-packing and grain center. Other industries include printing and publishing and the manufacture of drugs and medicines, automobile and airplane parts, hosiery, and wood and metal products. The city is governed by a mayor and council. Population (1950 census), 427,173.

INDIANA'S TRIBUTE TO HER HEROES

The Indiana State Soldiers' and Sailors' Monument is one of the conspicuous adornments of Indianapolis. It is 285 feet high.

INDIAN OCEAN. Two thousand years ago, when mariners were still venturing only the most cautious coastal voyages along the Atlantic coast, the Indian Ocean could already boast established trade routes, and the Egyptian Greeks boldly made their way across the open sea between Arabia and Hindustan though they had neither chart nor compass. They had nothing to fear if they avoided the hurricane months from December to April, for they had observed that the monsoon winds blow half the year in one direction, half the year in the opposite.

Washing the shores of Asia on the north, the Antarctic continent on the south, Africa on the west, and the East Indian islands, Australia, and Tasmania on the east, the Indian Ocean is the third largest of the four oceans. Its length from north to south is somewhat over 6,500 miles, its breadth 4,000 to 6,000 miles, and its area about 28,356,200 square miles. The average depth is about 13,002 feet (nearly 2½ miles). Its greatest known depth is 26,267 feet, sounded to the south of the island of Sumatra in the Wharton Deep.

At Cape Comorin, the southern tip of India, the Indian Ocean forks into the Bay of Bengal on the east and the Arabian Sea on the west. The Arabian Sea branches again into the Persian Gulf. Beyond the Arabian peninsula the Indian Ocean connects with the Red Sea. From Asia several great rivers enter it—the Ganges, the Brahmaputra, the Irrawaddy, the Indus, and the junction of the Tigris and Euphrates known as the Shatt-el-Arab; and from Africa the Zambezi and the Limpopo. In the Indian Ocean are the great islands of Ceylon and Madagascar. The rest of the islands—the Laccadives, the Maldives, Socotra, the Andamans, Nicobar, Mauritius, Reunion, Kerguelen's Land—are mostly small groups of volcanic or coral formation.

THE AMERICAN INDIAN AND HIS GIFTS TO THE WORLD

Here the Indian's gifts to the world surround a map of the Americas. Sketches on the map indicate Indian ways of life, or c tures, in various regions. In North America we see hunters, and women gardening and weaving; in Middle America, an Az priest and a Mayan sculptor. In South America we find an Inca official in the Andes; a blowgun hunter, a woman squeez manioc, and a farmer burning underbrush, in the tropical north; and a guanaco hunter and fishermen in a canoe, at the so

INDIANS—*The* FIRST PEOPLE *in* AMERICA

Herc Iroquois Indians are bringing in food and preparing it. These Woodland Indians lived among forests, lakes, and streams in the northeastern United States. The brave at the lower left has killed a deer in the woods with his bow and arrow. The other man carries a string of fish from the river. Pumpkins and squashes are stacked against a wooden mortar and pestle. These are used for grinding grain. The small boy holds a bark box of maple sugar. The old woman scrapes kernels from an ear of corn. Other food is cooking in pottery jars at the outdoor fireplace. The long houses are covered with bark. They will hold a dozen families.

INDIANS, AMERICAN. The first people in America were the Indians. They built their wigwams where the homes, schools, factories, and stores of modern cities now stand. They hunted deer or buffalo over land where today huge crops grow. Their hunters, warriors, and traders used paths now followed by roads and railroads. Indian farmers were the first to grow the corn, potatoes, and many other food plants that help to feed the world today. Indian words dot America's map. Many states, cities, rivers, and lakes bear names from the languages of the first Americans.

The Indians had lived in America for many centuries when white men first came from Europe. When Christopher Columbus discovered America, he called the natives Indians (*Indios* in Spanish) because he thought he had reached India. Other early travelers also made mistakes. They called the Indians "red men," although their skins are copper-colored to cinnamon brown, not red.

Where Did the Indians Come from?

Like the early white settlers, the first Indians were immigrants. Anthropologists say they came from

AN INDIAN WOMAN'S GARDEN

Here a Woodland woman hoes her garden with a stone hoe. With no plows or other farming tools, these Indians raised such crops as corn, beans, pumpkins, gourds, and sunflower seeds. They cleared the ground by burning trees and brush.

THE PLAINS INDIANS LIVED BY HUNTING BUFFALO

At the top a herd of buffaloes, or bison, goes thundering over a western plain. Indian hunters are galloping their horses into the herd and killing the animals with spears or bows and arrows. Since the buffaloes supplied most of their needs, the Plains Indians followed the herds. They lived in tepees made of buffalo hide. Some tepees are shown in the camp scene at the bottom. Here one woman is cooking chunks of buffalo meat over a fire. Another is scraping a hide. Strips of meat are drying on a rack at the rear. The woman at the right is pounding dried meat and berries in a rawhide bowl to make pemmican.

northeastern Asia. They resemble the early Mongoloid people of that region. Nobody can say exactly when or how they came. But many scientists believe that they arrived when ice sheets covered much of the northern part of North America (*see* Ice Age). The time may have been anywhere from 15,000 to 20,000 years ago.

They may have come because they were wandering hunters, like almost all other people in the world at that time. They crossed the narrow Bering Strait to Alaska, seeking new hunting grounds. Bridges of land existed at the time and made passage easy. There seem to have been ice-free land and game in Alaska, and a wide strip of open land east of the Rocky Mountains led from Alaska into the heart of North America. Perhaps the Indians moved on along this strip as they needed new hunting grounds. Gradually the ice

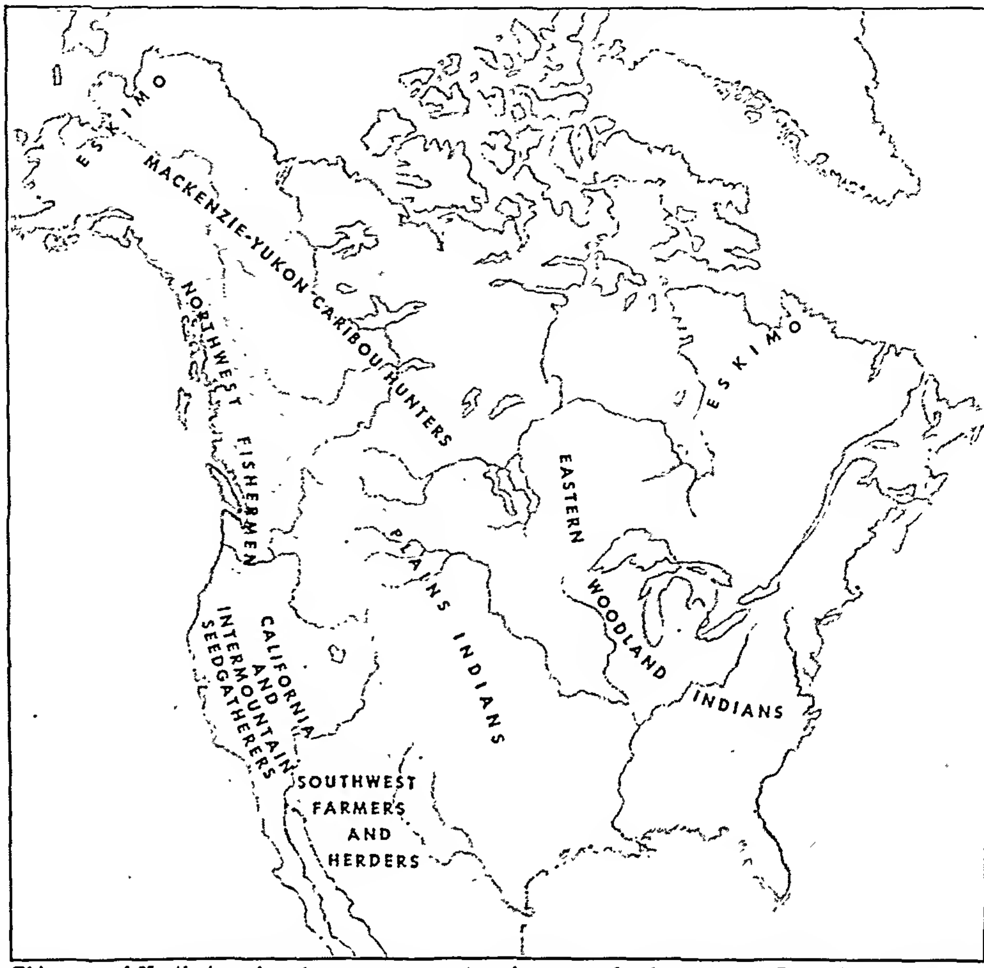
melted and the Indians spread to almost all parts of both Americas. But they did not fill the vast area. It has been estimated that only about 1,025,000 Indians were living north of Mexico when the first white men came to America.

How Indians Lived in Different Regions

The Indians lived in different ways in various parts of the country. When a wandering band found a place with good hunting and plenty of seeds and berries, they settled down. Gradually they learned how to use the region's trees and plants, its animals, fish, and birds, its stones and earth, to fill their needs.

So vast a part of the world as North and South America has many kinds of land and climate. In each area nature gave the Indians special plants, animals, and other materials. Thus people of various areas had different food, clothing, and shelter. They worked out different ways of life.

AREAS WHERE INDIANS LIVED IN SIMILAR WAYS



This map of North America shows seven great regions, called culture areas. In each one, Indians followed much the same way of life. The Eastern Woodland Indians were scattered over the forested eastern section. The Plains hunters roamed over the grassy interior. The Southwest Farmers and Herders lived on the dry uplands of Arizona and New Mexico. The California and Intermountain Seed Gatherers were desert wanderers. Fishermen lived along the rainy northwest coast.

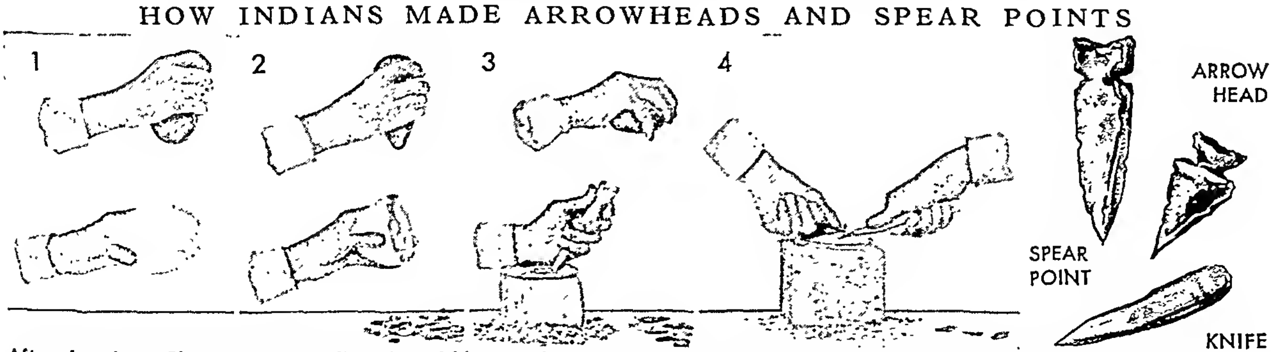
Since the Indians depended upon nature they studied its ways. They knew the habits of the animals. They found out which plants were nourishing and which poisonous. They knew signs that foretold the turning of the seasons and the changes in the weather.

They had no science to explain natural phenomena, and so they believed the sun, the rain, and other forces were controlled by spirits. In their religions they worshiped the animals, the plants, the sun, rain, and wind. In ceremonies and private prayers they sought to gain the favor of these beings.

Culture Areas in North America

Scholars give the name "culture" to the ways of life of a people. After studying Indian cultures north of Mexico, they find seven great *culture areas* in the region. These are shown on the map above. In each

HOW INDIANS MADE ARROWHEADS AND SPEAR POINTS



After choosing a flint stone, the Indian shaped his arrowhead, spear point, or knife by methods shown above. Pictures 1 and 2 show him using a hammerstone to break the flint and split off thin flakes. In 3, he sets a dull antler point against the edge of a stone flake and gives it a sharp rap with a hammerstone. This chips off a piece for an arrowhead. Picture 4 shows him pressing sharply against the edge to break a small chip from the under side. Thus he shapes the point and gives it a sharp, slanting (beveled) edge. A skilled worker could complete a spear point or arrow point in five minutes or less.

SKILLED FARMERS AND CRAFTSMEN OF THE DRY SOUTHWEST

Here the people of the Hopi pueblo, or village, of Walpi are working skillfully at their crafts. Their home is a big "apartment house" of stone and a sun-dried clay called adobe. They are making baskets and pottery and are spinning and weaving. They wear woven clothing and pretty silver jewelry. Overhead hang seed corn and peppers. The Pueblo Indians raised fine crops by irrigating the dry fields. They did not have to spend all their time hunting or gathering food. They had lived in villages for centuries and had become highly skilled at crafts long before white discovery. The picture is from a diorama at the American Museum of Natural History.

area the Indians shared the same kind of natural surroundings and had much the same kind of culture. Peoples who lived along the border between two culture areas often reflected the two ways of living.

The pictures on these pages illustrate ways of life in five of the areas. They show that in each one the Indians had special ways of getting and preparing food and of making houses, clothing, and utensils.

One thing all had in common was the use of stone tools. All made a variety of hammers, scrapers, knives, arrowheads, and spear points from stone. In a few places they found pieces of native copper they could hammer into ornaments or into an occasional tool. But they were handicapped by not having the sharp metal tools white people use.

Settled Life in the Eastern Woodlands

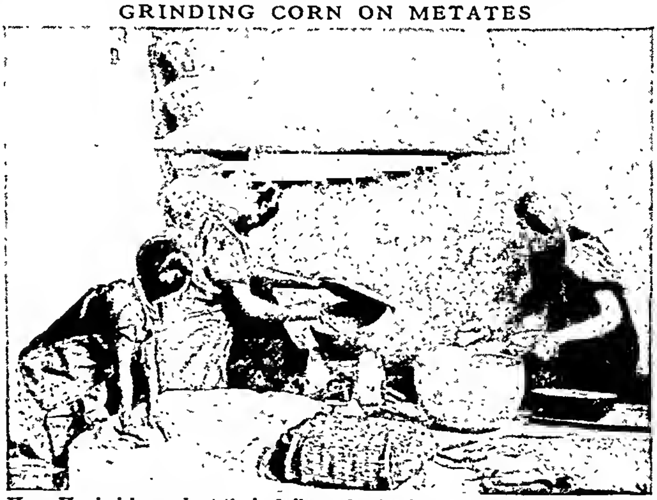
The Indians who made their homes in the eastern part of North America had a land with plentiful rainfall. Great forests spread over mountain and valley and there were many lakes and streams. The Woodland tribes depended largely upon the trees, the animals that lived in the woods, and the fish and shellfish from the streams and the sea. They used tree bark and branches to make their houses, many of their weapons and utensils, and the canoes in which they skimmed over the water. They made clothing from the skins of deer and other game.

They did not have to wander seeking wild food. Since they knew how to grow crops, they could live in villages. The women planted corn, pumpkins, squash, beans, tobacco, and gourds. The plants flourished in the warm, rainy summers.

Wanderers on the Western Plains

The Plains Indians lived on a vast, rolling plain. It had enough rain for a thick carpet of grass, but not enough to grow many trees. Trees grew only beside

GRINDING CORN ON METATES



Here Hopi girls work at their daily task of grinding corn. They use two or more stones, called metates, to grind the meal fine, then dry it at the fireplace. Their mother is baking batter for *piki*, or paper bread, on a flat stone. The young girls wear the "butterfly" hairdress. This exhibit is from the United States National Museum.

HOW SEED GATHERERS CAMP ON THE DESERT

This Paiute family is making camp on the desert after spending a day searching for food. In their hot and nearly rainless climate they do not bother to huild a house. They have piled up a windbreak of sagehrush and dwarf juniper and weighted it with a few things they carry. Among these are a fish or rabbit net, some haskets, a wicker seed beater, a skin robe, and the metate and muller for grinding seeds. One hasket holds pine cones. The basketry hottle is covered with piñon pitch to make it waterproof. While the youngsters make a fire the father skins a rabhit for dinner. This picture is from a diorama in the Milwaukee Puhlic Museum.

the rivers. Huge herds of grazing animals fed on the grass. The most important of these was the buffalo, or bison. Indeed, the buffalo has been called "the Plains Indians' galloping department store." These animals gave the Indians almost everything they needed. The flesh supplied food. From the skin they made tents, called *tepees*, boats, utensils, baggage, and part of their clothing. They moved about over the plains following the herds.

After Spanish settlers in the Southwest brought horses to America, the Plains Indians became prosperous and successful hunters. With their swift ponies they could overtake a herd of buffaloes and kill all the animals they needed.

Living in the Dry Southwest

The Indians of the Southwest had land that was high, dry, and cut by mountains and canyons. They had little rain, but it came mostly in summer when it would help plants grow. Snow fell on the mountains in winter and supplied water for streams, springs, and water holes. The Pueblo Indians and several other groups learned to irrigate their fields with this water and to find moist spots for dry farming. Good crops gave them a dependable food supply. They also used the materials of the region for developing many arts and crafts. They made fine pottery from the clays, wove baskets and fabrics of cotton and wild fibers, and made useful tools from the stones. They built large dwellings like apartment houses from stone and adobe (sun-dried clay). A whole village, or community, lived in one of these huge houses. When Spanish explorers found them in the 16th century, they called the community houses "pueblos" from the Spanish word for village.

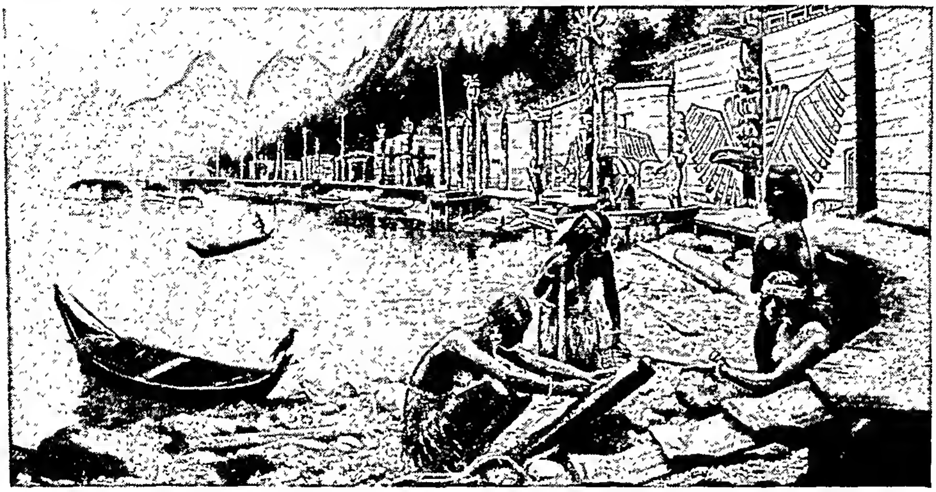
PAIUTE MOTHER

This lucky Seed Gatherer woman has buckskin for a dress and a cover for the wicker cradle.

This region also had hunting Indians who did not build villages. The Navajos were hunters until the Spaniards brought sheep and goats. Then they changed gradually to tending flocks of these animals for a livelihood. They moved over the dry, rocky land seeking grass for their flocks. They made homes (*hogans*) of stone, logs, and earth.

The Seed Gatherer Indians had an even drier homeland. They lived in the arid parts of California and in the desert between the Rockies and the Sierra Nevada. Game animals were scarce and the men could not supply enough food by hunting. So the family roamed over the desert while the women gathered berries, nuts, seeds, and roots. They ground the seeds into flour for gruel. They built mere windbreaks or flimsy huts covered with rushes or bunches of grass. Their greatest skill was in basketmaking. They wove the baskets so closely that they

SEASIDE VILLAGE OF A NORTHWEST FISHING TRIBE



This village in British Columbia sits between the mountains and the sea. The big houses are built of slabs split from tall red cedar trees. Before each house stands a totem pole. The strange faces carved on the pole are those of mythical animal and human ancestors of the household. In the foreground a woman is cleaning fish with a clamshell knife. The girl beside her carries a basket of clams and the digging stick she used to pry the shellfish from the beach sand.

would hold the finest seeds or even water. The women cooked gruel in them.

Indians of the Northwest and North

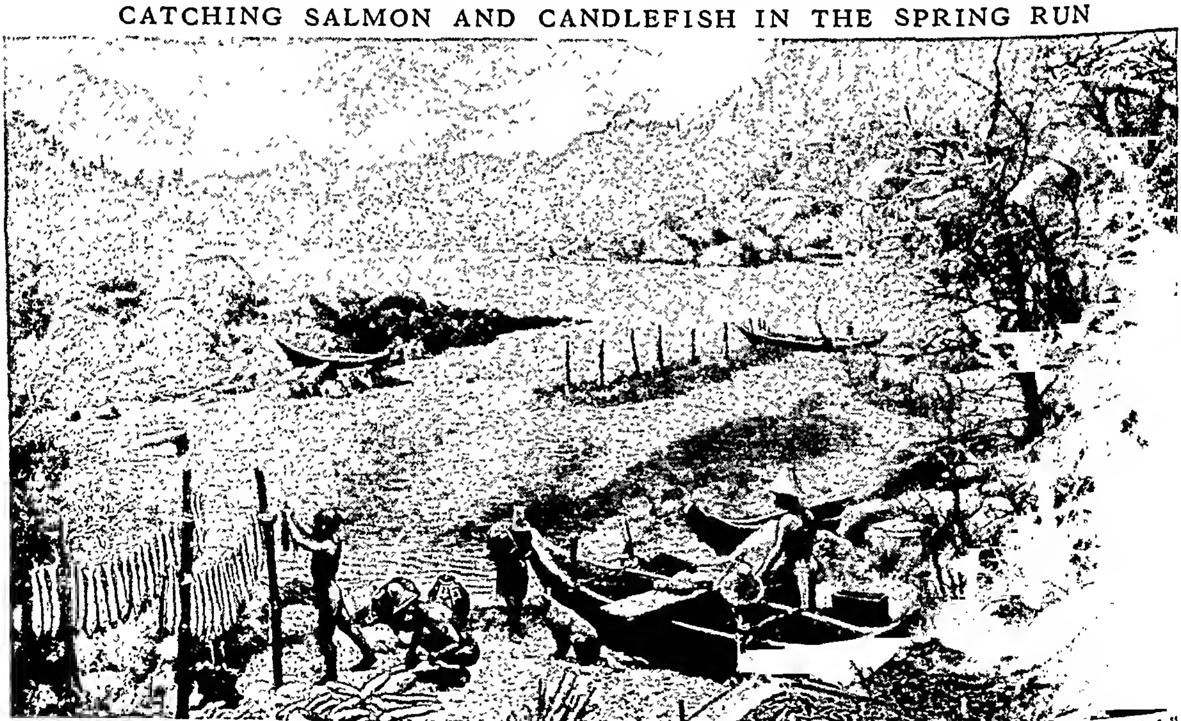
The Northwest Fishermen had a land of heavy rainfall along the northern Pacific coast. The ocean and the rivers were rich with fish. Forests grew tall and dense. The giant red cedar provided straight-grained wood that could be split even with crude tools. So these skillful Indians built large houses by tying big slabs of cedar to wooden frames. They made dugout canoes for river travel and sea-going whale boats.

Hunters added game to the fish supply and the women gathered bulbs, berries, and seeds. They wore little clothing—fringe skirts and raincoats made from the inner bark of the cedar. They were skillful wood carvers.

North of these five great culture areas lived the Mackenzie-Yukon Valley Caribou Hunters and the Eskimos. Caribou Hunters depended upon the caribou and other northern game, much as the Plains Indians depended upon the buffalo. They made their tents and clothing of caribou or deer hides. They tracked their game in winter on snowshoes. Dogs carried the baggage as they roamed, or pulled it on sledges.

The Eskimos still live today along the chill northern fringes of the continent. They depend upon seal, whale, walrus, caribou, polar bear, Arctic birds, and other Arctic animals (*see* Eskimos).

CATCHING SALMON AND CANDLEFISH IN THE SPRING RUN



Here Northwest Fishermen are preparing their year's supply of smoked salmon and candlefish oil. It is spring and the river is full of fish swimming upstream to lay eggs. The men have built a weir, or trap, to catch them. The tiny, oily candlefish are swept between the two fences. A man in the canoe beyond dips them up with a net. He puts them in the pit at the left to decay. Next they are thrown into the dugout canoe filled with water. The women toss hot rocks into the canoe to cook out the fish oil. At the left salmon are smoking on a rack. Both pictures on this page are from dioramas in the Milwaukee Public Museum.

GAMES AND TOYS OF INDIAN CHILDREN

Indian children everywhere enjoyed active games. These are Kiowa youngsters of the plains. They are wearing the fringed and beaded Plains clothing and are using a small tepee in their fun. The two in front are playing the hoop-and-spear game. The girl is throwing a netted hoop. The boy is ready to hurl his spear into the netting. Behind them a small boy and his sister are "attacking" the tepee while playing "warrior." The children at the right rear are spinning whip tops.

Games, Sports, and Ceremonies

THE INDIANS did not give all their time to the work needed to keep alive. Young people and adults alike had many games and sports. At times tribes called together their members for festivals that lasted a week or more. The gatherings usually had religious ceremonials as their main purpose, but there was time for games and visiting, storytelling, and social singing and dancing.

Children played much as children play today. Girls played with dolls dressed in the costumes of their tribes. Boys shot small arrows from toy bows and crept silently through the woods pretending to be hunters or warriors. There were whip tops to spin, stilts, slings, and other toys. They had dogs and small wild things as pets. Around the fire in the evening, old and young played guessing games like "hunt-the-button." They made complex "cat's cradles" with fiber string.

Children learned skills from games then as they do now. Archery, target practise, and foot races taught skills needed by the hunters. Pueblo children learned about *kachinas* from their kachina dolls. The kachinas

DOLLS OF THREE REGIONS

At the left a Pueblo girl is playing with her kachina doll. Pueblo children have many kinds of kachina dolls dressed like the famous kachina dancers. The one to the right of the child is the cow kachina. The center doll wears the Plains Indian dress. The Eastern Woodland doll, at the right, was made from cornhusks.

were mythical ancestors of the Pueblo people. They were thought to live in a lake beneath the earth. The tribes held kachina dances to celebrate visits from the spirits. The dancers gave kachina dolls to children, to inspire them to be like the kachina ancestors.

Intertribal Meets and Women's Games

Young people competed in athletic sports. The "ball play" popular throughout the East has become the modern sport, lacrosse. Athletes were highly trained for intertribal contests in this game. The ceremonial dancing and feasting before the games may be compared to modern football "pep rallies." Intervillage foot races were held by the Pueblos and horse races were popular among the Plains buffalo-hunting tribes.

Ring-and-pole and hoop-and-pole games were played in many regions. The players shot poles or spears through stone rings or into a netting on a hoop. "Snow snake" was popular among northern tribes. The players hurled a long stick, sometimes painted to resemble a snake, to see who could send it farthest over the ice or frozen ground.

WOMEN PLAYING THE PLUM-STONE GAME

Here a player is tossing plum seeds from a bowl. They are marked with different designs. Her winnings depend upon the design turned upward when the seeds fall. The players keep score with the beans before them.

Shinny was a woman's game. Plains women used a small buckskin-covered ball of buffalo hair. Women of the Southwest played a kind of football, very different from modern football. They kicked a small ball around a long course. In early times, the game was thought to have magical powers and to protect the fields against sandstorms.

Games of Chance

Indians of all tribes liked games of chance. The commonest was called the hand game. A player held in his hands two bone or wooden cylinders. One was plain and the other marked. His opponents attempted to guess which hand held the unmarked piece. At big games held on the plains, one camp sometimes played against another. Backers lined up besides the players, shouting and singing to distract the guessers. A man might lose his horses, buffalo robes, and everything he owned in the excitement.

Numerous games used markers resembling dice. Common among northern tribes was the bowl game. Players tossed marked peach or plum seeds in a bowl.

Dancing and Ceremonials

Most of the Indian dances and ceremonies were held for religious or magical reasons. By honoring their spirits, or gods, the Indians hoped to gain help and favor. Medicine men, or religious leaders, danced to seek aid for the sick. Hunters danced the deer dance or the buffalo dance to attract abundant game. Farming people staged ceremonials to bring rain or to make the corn grow or ripen. Certain dances dramatized stories from the history or mythology of the tribe. Other ceremonies were held when children arrived at manhood or womanhood, or to initiate them into the religious secret societies of the tribe.

Though the purpose of the dance was serious, the Indians usually made it the occasion for fun and sociability. In many tribes, there were clowns or other fun makers among the musicians or dancers. In the evening, or at the end of the festival, social dances were sometimes held. The squaw dance of the Navajos was a social dance in which men and women joined. Originally it came at the end of elaborate ceremonials to welcome the braves at the end of a war.

Song and Musical Instruments

Singing accompanied every public ceremony as well as the important events in an individual's life. Both the tune and rhythm seem strange to white ears. Religious songs passed down from generation to generation, as they were an important part of the ceremonies. Women sang songs not only to help them at their own activities, such as spinning and grinding, but also to encourage the warrior as he went forth. Every mother, of course, sang lullabies. Birds or animals, in folk stories, were supposed to sing their own quaint songs, which were imitated by the storyteller. On the northwest coast there were spirited song contests between tribes. Certain songs were the exclusive property of clans and societies. Individuals in the clan, however, could sell their songs or give them away.

A variety of instruments accompanied dance and song. These included drums, rattles, whistles, flutes, bull-roarers, and notched sticks rasped on bones. The Indians made them of materials at hand. Plains drums had painted horsehide heads. Northwestern tribes used wooden boxes, and their rattles were made like masks from carved wood or native copper. The Pueblos and other farming tribes made gourd rattles. The Iroquois of the forests used a turtle shell and a pot or water drum.

Every tribe had its legends, some more fanciful than true, of the history of the tribe. When the day's work was done the old people would tell these tales. There were also many stories of animals and mythical beings which could assume human form and yet retain some of their own particular traits. Children were thrilled by these stories.

PUEBLO CORN DANCERS AND THE KOSHARE, OR DELIGHT MAKER

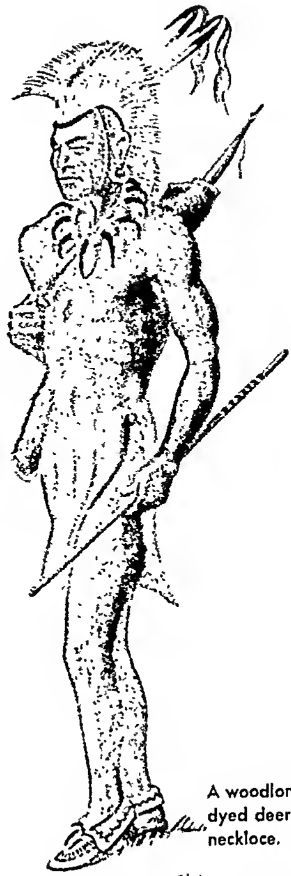
This painting shows one of the corn dances each pueblo holds to make the grain grow. The striped figure represents the *koshare*, or holy clown, who is believed to have brought laughter to the earth. Other men dancers wear a hand-woven cotton *kilt*, embroidered in bright wool, and a fringed rain belt. A fox skin hangs from the belt at the back. The women wear dark wool *mantas* and headdresses of painted wood and feathers. All carry evergreen, which stands for growth magic. The Zia artist, Velino Herrera, painted this picture. He has signed it by his Indian name, Ma-pe-wi, which means "red bird."

PLAINS HUNTERS DANCING TO BRING THE BUFFALO

Roland Whitehorse, a Kiowa artist, painted this picture of four buffalo dancers. The leader wears the horned head and tail of the buffalo. His "war paint" is his own secret "medicine," or magic. The braves in the center are dressed for the hunt. The medicine man, at the rear, grasps a lance and a rattle. His painted shield hangs from his shoulder. The important buffalo dances were held before the big tribal hunts of summer. Then the flesh was fat and the pelts easy to dress for clothing.

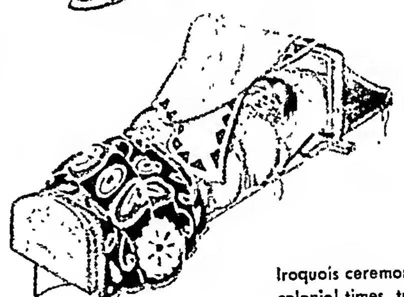
EASTERN WOODLAND CLOTHING FOR WORK AND CEREMONIALS

An Iroquois chief in bearskin robe and feathered headdress.



A woodland hunter with roach of dyed deerhair and bear-claw necklace.

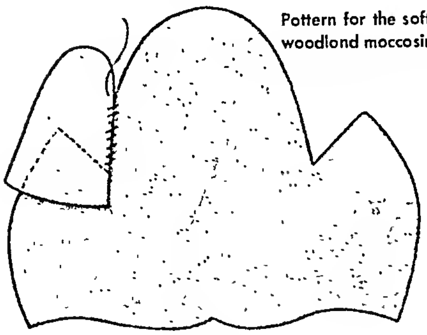
A woman at work dressed in buckskin wrap-around skirt.



A baby carrier of colonial times. Its robe is made of trade broadcloth, embroidered in dyed moosehair.

Iroquois ceremonial dress of colonial times, trimmed in fringe and quills.

W. Langdon Kihn



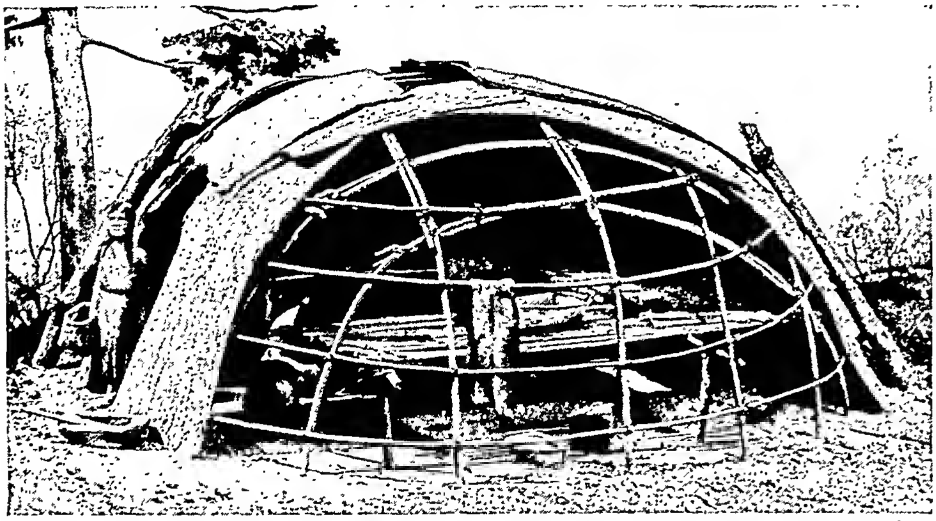
Pattern for the soft-soled woodland moccasin.

Iroquois moccasin with beaded tongue.

Bead design of vines and flowers for a moccasin tongue.

Forest Indians wore few clothes at work. The hunters wore a buckskin breechcloth, or double apron, and soft moccasins. The women had only a short skirt. The ceremonial costumes were trimmed in porcupine quills, and later in European beads. The men stuck a few feathers in a headdress or fastened a dyed deer-hair roach to the scalp lock. They decked themselves in ornaments of shell, bone, or animal teeth and claws. In winter they added fur robes and wore leggings and fur sleeves, or arm muffs.

HOW EASTERN FOREST INDIANS BUILT A BARK WIGWAM



Here the bark covering has been taken from one side of an Ojibwa wigwam to show how it was built. First, the Indians cut small, flexible trees, or saplings, and stuck them firmly in the ground in a circle. Then they bent the saplings overhead in an arch and tied them together with tough bark fibers or with rawhide. Next the builders ran other poles in circles around the upright ones and tied them together. Slabs of bark were next tied to this frame to form the roof and walls. Space was left for a door and a smoke hole. These holes could be closed to keep out rain. Platforms inside served as beds, chairs, and shelves.

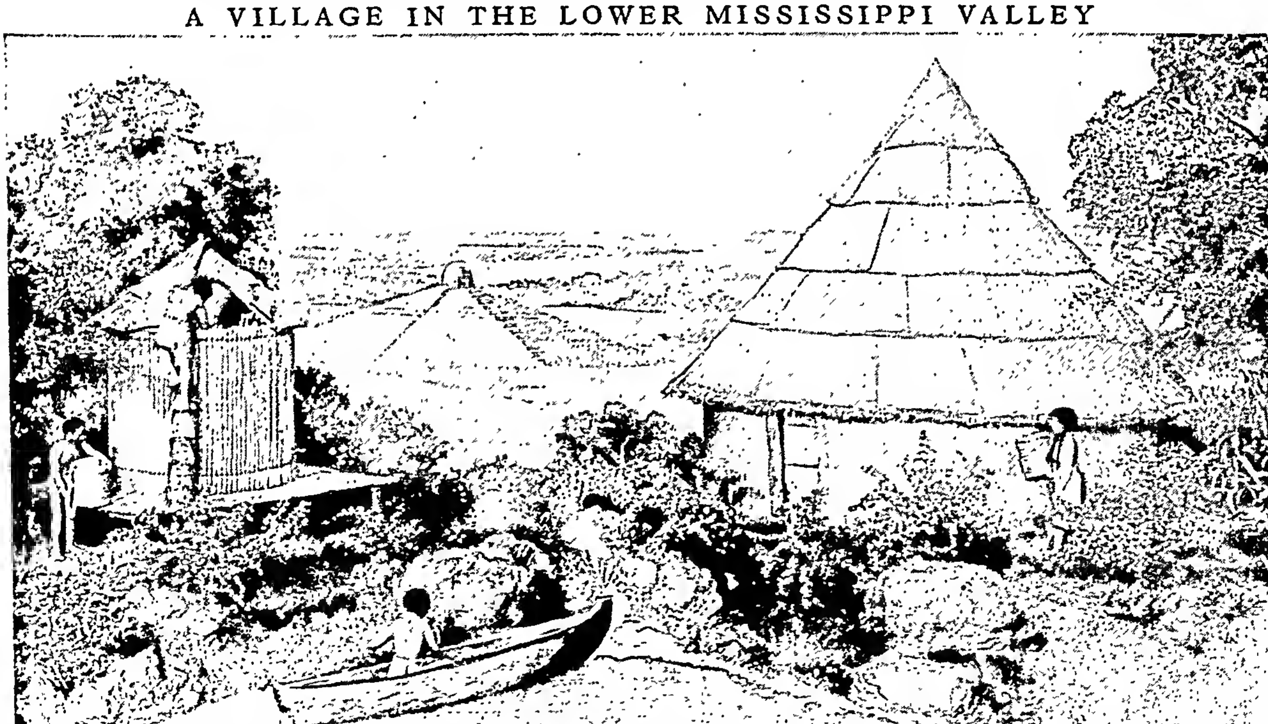
Eastern Woodland Indians

The Indians of the eastern forests were the first the American colonists met. In the beginning, the settlers from Europe looked upon the Indians as ignorant savages. Then they found that there was much they could learn from them. They learned to grow corn, fertilizing the plants by dropping a fish in each hill. They adopted the Indian's swift, graceful bark canoe for water travel. They found out how to hunt and to make war, Indian style.

Indian ways were useful to the colonists because they were suited to the wilderness of forest, rivers, and lakes. The Indians knew how to use the plants, animals, and other things around them to supply food, clothing, shelter, weapons, tools, and utensils. They had to use them in order to fill their needs. There were no stores in the wilderness to sell a family anything it could not get or make for itself.

From the beginning, the American people have used Indian methods and equipment when living in the

A VILLAGE IN THE LOWER MISSISSIPPI VALLEY



The Natchez tribe of the warm southern lowlands built a home that differed from the bark houses of the north. It had a steep, cone-shaped roof to shed the heavy rains. Its sapling framework was covered first with a plaster of mud and Spanish moss and then with neat mats woven from cane. Nearby is the village corncrib. A man stands on its log ladder emptying his basket of corn. Another man has just arrived in a dugout canoe. Notice the huge pyramid of earth in the background. These mounds were common in the Mississippi Valley. They served as bases for temples. Pictures on this page are from the American Museum of Natural History.

eastern forests. The fur traders patterned their lives on the Indian's. They traveled in canoes and on snowshoes, wore moccasins and other buckskin clothing, and ate Indian food. The pioneers often wore buckskin too, and the women followed many Indian recipes in their cookery. Today's campers and hunters use methods their forefathers learned from the Indians. Modern Boy Scouts, Girl Scouts, and Camp Fire Girls study Indian lore. They learn how to make fire without matches, how to cook over a campfire, and how to identify useful wild plants.

Kinds of Houses in the East

All the Eastern Woodland Indians lived in much the same way. But there were differences in climate and available plants and animals, from place to place, and the tribes differed in house and clothing styles, in food habits, and in means of transportation.

Pictures in this section show houses from different parts of the East. Perhaps the most widely used was the bark-covered wigwam. Sometimes it was shaped like a cone and sometimes it was rounded over the top. The Iroquois built the much larger long house. In it a dozen families might live together.

In the warm southeast, certain tribes raised bigger crops and had a more involved culture than the northeast tribes. They had winter houses of clay plastered on a framework of poles and woven twigs, with a domed or cone-shaped roof. The Seminoles in Florida used palmetto-thatched shelters without side walls. These people still live in this type of house

All the houses were crowded by modern standards, but the Indians did not mind. Every family spent most of its time outdoors. In good weather the women cooked at an open fire and did much of their work sitting outside.

THRESHING WILD RICE IN WISCONSIN

These Menominee Indians are preparing wild rice for winter. In the distance people in a canoe are beating the rice from the stalks. The man in the foreground is threshing the grain. He has poured it into a pit lined with rawhide. He tramps on it to break off the husks. The woman tosses the rice in a bark basket so the wind will blow the husks away. She will dry the grain over a low fire. Notice that mats of cattail stalks cover the wigwam. This picture is from the Milwaukee Public Museum.

Life in a Woodland Village

Eastern Indians lived in villages clustered beside a lake or stream. They drove sharpened poles into the ground to make a high fence, or palisade, around the town to protect it from attack. The women had their garden patches beyond the fence. When the ground lost its richness through years of planting, or the game in the neighborhood became scarce and the firewood was burned, the villagers left their old homes and moved to a new location.

The village was a busy place. Men and women shared the work, but the men's share sounds like more fun than the women's. They hunted the forest animals to get meat and hides for food and clothing materials and trapped or seined fish. But there was time between hunts to join war parties and to take part in religious and medicine-society ceremonials and to sit in the councils of the tribes.

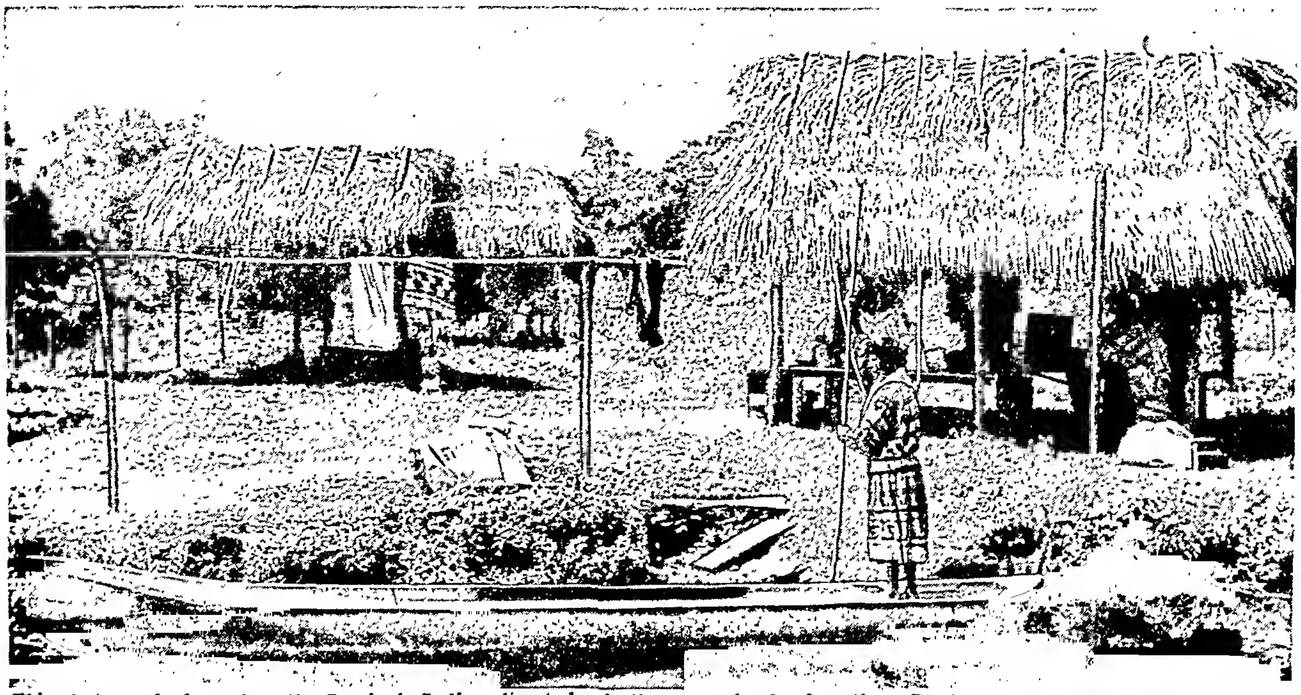
The men helped with building wigwams, and clearing the ground for gardens by burning off the trees and bushes. Trees were felled by "girdling." A fire set at the tree's base charred the wood so the man could chip it with his stone ax until the tree fell. A ring of wet clay kept flames from spreading up the trunk Skilled men of the tribe made the bows and arrows, war clubs, and stone knives.

Preparing Food

The women's many chores kept them busy all day. They wrapped the babies in moss and furs and bound them to wooden cradleboards. They carried the boards on their backs when they gathered food in the woods. In the village they stood the boards by the house. In the garden they hung the baby and cradle on a convenient branch.

They planted corn, beans, pumpkins, squash, tobacco, and gourds in the gardens. They harvested the crops and prepared the food. It was easy enough to roast green corn in a pit with hot rocks or to broil meat or fish on a grill of green twigs over the fire. But most jobs were harder To grind the dry corn into meal they pounded it in a mortar made of a hollowed log, with a small log for a pestle. They made hominy by soaking the grains in a solution of wood ashes

SEMINOLE SHELTERS IN THE FLORIDA EVERGLADES



This photograph shows how the Seminole Indians live today in the swamplands of southern Florida. They have no need for a snug house in their warm climate. They build open sheds, called "chickees," from the palmetto trees that grow in the region. Six tree trunks hold up the roof. It is covered with a heavy thatch of palmetto leaves. The floor is high off the soggy ground. The women sit here at their work, and the floor serves as a bed at night. The man in the canoe pushes it through the swamp with a pole. He wears the Seminole costume of bright cotton cloth. This clothing was copied from the dress of early white settlers.

that loosened the tough hull of the kernel. They parched, or toasted, corn for warriors on the march. They dried corn, squash, berries, meat, and fish for the cold months. They stewed corn and beans into succotash and made soups of corn with meat or fish, in pottery jars.

Some areas offered special things to eat. In the forests of the northeast, the Indians tapped the sugar-maple trees and boiled the sap to make sugar. The Ojibwa and other tribes of the northern Great Lakes area had plenty of wild rice for their grain supply and they did not need to raise garden crops. The seashore and many rivers offered shellfish. Heaps of discarded shells mark the sites of many ancient camps.

How the Clothes Were Made

Hours and days of work went into the making of the buckskin garments the Indians wore. Tanning deer hides called for many processes. They included scraping off flesh and hair with dull bone scrapers, washing the hide, treating it with a deer-brain mixture, and sometimes smoking it to yellow and waterproof it.

Tailoring the garments meant cutting the skins with shell or flint knives and sewing them with animal sinews. Awls and needles were made of bone and horn. Indian women added beautiful colored porcupine-quill embroidery. They created

TOOLS AND UTENSILS

Here are things the Eastern Woodland Indians made to help in their work. They used materials found near at hand. The basket net was placed in a stream to trap fish. The dish and ladle were carved from wood. Notice the animal carved on the ladle handle. The pottery jar could be hung over the fire by a cord or a rawhide thong under its rim. The hoe blade was first chipped from stone and then lashed to the short handle with wet rawhide. The hide tightened as it dried. The women carried heavy loads on the burden frame made from hickory twigs. It hung on the back from a strap, called a tumpline, passed around the forehead or chest.

WOODLAND WOMEN TANNING BUCKSKIN

Tanning deerskin called for many tasks and skills. The girl at the left is scraping the flesh from a skin stretched on a frame. The second woman scrapes off the hair with a hone scraper. Next the skin is washed and wrung out. After it dries it is stretched into shape by pulling with the hands and feet. The woman at the right smears a deer-brain mixture on a skin to soften and cure it. This picture is from a diorama at the American Musenm of Natural History.

designs of the flowers, leaves, and vines they saw in the woods. They decorated ceremonial costumes richly.

At work the women wore a plain wrap-around skirt and the men, a breechcloth. The men usually cut off all their hair except a scalp lock. Their headdresses were of dyed deer hair or a few feathers. (The forest would have been a poor place for the war bonnet of the Plains Indian. The tree branches would have torn off its feathers.) Winter's fur robes left one shoulder bare.

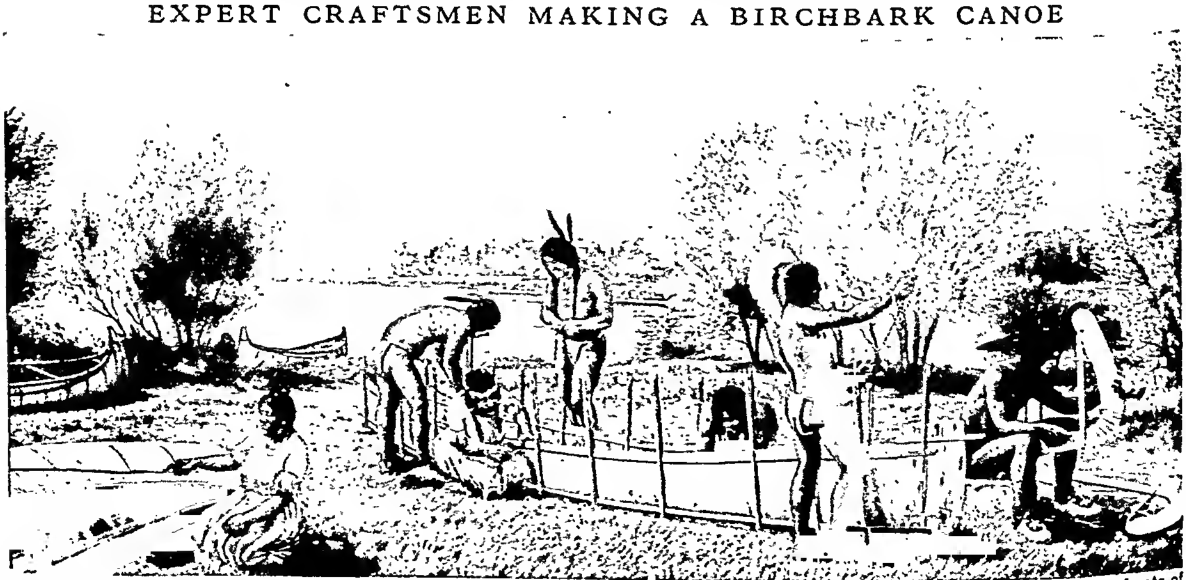
Baskets, Pottery, and Boats

Women of many eastern tribes knew how to weave mats, baskets, and belts from shredded bark, wood splints, and other fibers. Most tribes of the region made pottery jars for cooking and storing foods. Boxes and dishes were fashioned from bark and wood.

The Eastern Woodland Indians traveled fastest by water. The northern tribes made bark canoes in which they skimmed swiftly and silently over the lakes and rivers. Southeastern tribes made dugout canoes. They hollowed out a log by burning the inside and scraping away the charred wood. The Indians used their canoes in hunting and fishing. From their canoes they could readily shoot the fleet deer and moose when the animals were wading or swimming.

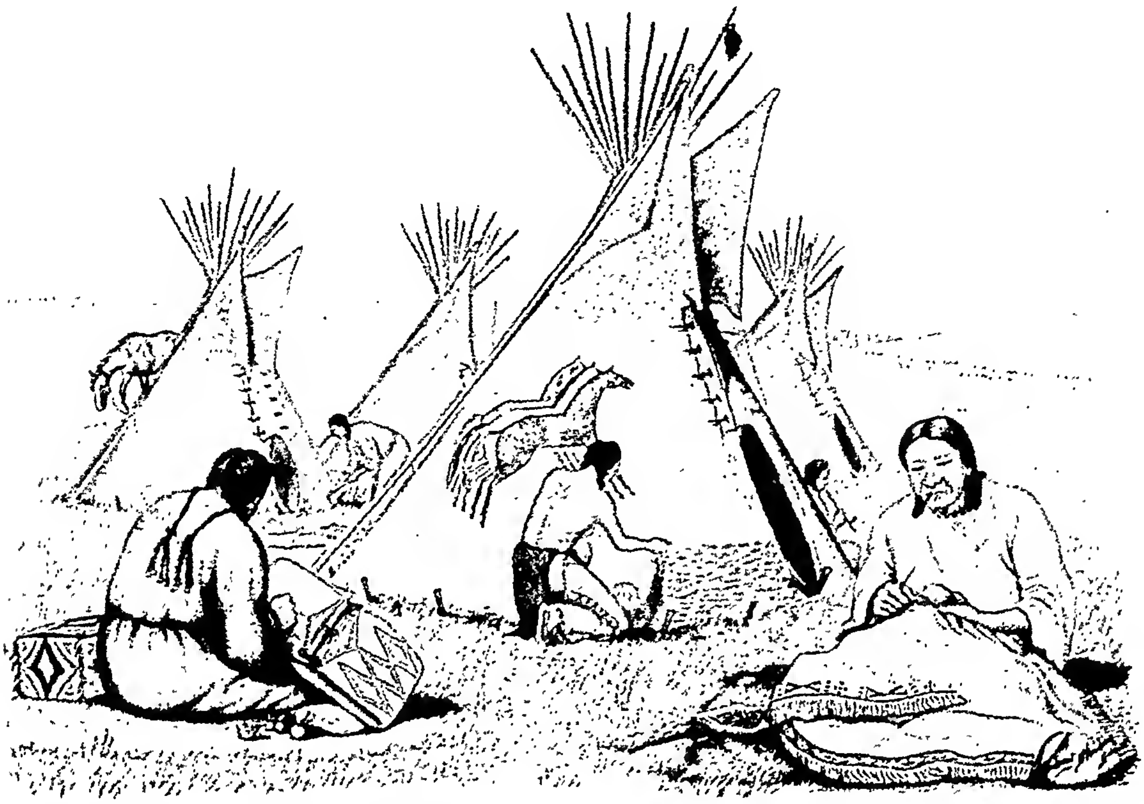
On land the Indians traveled on foot and carried burdens on their muscular backs. They had no draft animals to haul loads and their roads were only narrow paths. The dog was their only domestic animal. In winter the northern hunters could move swiftly after their prey on snowshoes.

EXPERT CRAFTSMEN MAKING A BIRCHBARK CANOE



To make a hirchhark canoe, the Indians first drove stakes in the ground outlining the shape of the boat. Then they cut sheets of hark the proper size and placed them within the stakes. They made curved ribs of cedar and a light framework of spruce, and set crosspieces, or thwarts, between the sides to hold the canoe in shape. Then they sewed the sheets of bark together. The woman in the center is lacing the bark to the side piece (gunwale). The man at far right is shaping a frame for the pointed ends of the hoat. The woman at far left paints pitch on the seams to make them waterproof. (Picture from Milwaukee Public Museum.)

A SIOUX BRAVE PAINTS A NEW TEPEE



Tepee painting began with ceremonials and prayers. The color at its top represented the night sky and the bottom color, the earth. The horses show success in capturing ponies in raids. Red on the tepee at the left indicates that its owner has been killed in battle. In the foreground one woman is painting a parfleche and another is embroidering with porcupine quills. This picture was painted by Andrew Standing Soldier, a Sioux artist.

Indians of the Plains

TODAY the word "Indian" makes most people think of the Plains Indian brave. He is remembered as a majestic figure with strong, sharp features, a dignified manner, and a colorful costume of beaded and fringed buckskin. He was a splendid horseman, hunter, and mounted warrior who took pride in defending his plains hunting grounds against the invasion of white settlers. In war, his long-tailed war bonnet of eagle feathers streamed in the breeze as he galloped over the plain.

Game was plentiful on the plains. Buffalo and antelope grazed over the grassy land. In the hills and mountains near by lived deer and elk, grizzly bears, mountain sheep, and mountain goats. The buffaloes were the most valuable game animals. But the big herds moved about constantly seeking pasture, and the Indians had a hard time catching them when they had to hunt on foot. After horses were brought to North America from Europe the Plains tribes became successful mounted hunters and spent their lives following the herds. Spanish settlers first brought horses to the Southwest. Between 1650 and 1750 they spread to the plains.

Before the coming of the horse this splendid hunting ground contained but few Indian tribes. Most people here lived in the river valleys where they could raise corn. Their homes were villages of earth huts.

At buffalo-hunting time, a tribe moved after the feeding herds on foot. They had invented a dwelling they could carry—the tepee. They made an A-shaped drag, called a "travois" (*trăv-wä'*), on which their dogs hauled the tepee cover of buffalo hides and other gear. The tents were small because the dogs could not pull heavy loads.

Buffalo Hunting without Horses

The hunters had worked out cunning methods by which they could kill enough buffaloes to supply the tribe with meat and hides. If the herd was scattered, a few hunters might move softly among the animals and shoot several without scaring the others. In snowy weather, Indians on snowshoes would encircle a herd and kill many of the animals before they could flounder away.

An effective method was to drive the herd over a cliff. One man, draped in a buffalo robe, would move ahead of the herd toward the cliff. Then other Indians would jump out behind the animals, shouting and waving robes. The buffaloes would begin to trot, then gallop in terror, the animals in the rear pushing those in front. The decoy leader would dodge to safety at the last minute and the crazed herd would pour over the precipice. Many were killed in the fall. The injured were finished with spears or clubs.

After the hunt, the work of the women began. They skinned the carcasses and cut up the meat. Some choice

INSIDE AN EARTH LODGE IN THE MISSOURI VALLEY

In this picture, the artist Charles Bodmer shows a Mandan earth hut he visited in 1833–34. It served a chief's family as stable and kennel as well as home. The chief sits on a willow-rod backrest beneath the smokehole for the central fireplace. A draft-shield shelters him from the outer passageway. He welcomes visitors by passing them a pipe of tobacco. On the heavy posts supporting the roof hang his clothing and hunting gear. These include shields, buffalo robes, bows, arrow quivers, tobacco sacks, and a medicine bundle. Spears lean against one post and a bullboat paddle against another. Earth huts might be 30 to 60 feet in diameter.

parts were eaten right away. The meat might be hung on green branches over the fire to cook. Or it could be boiled by dropping hot rocks into the cooking "pot." The pot itself came from the buffalo. Sometimes a buffalo stomach or a piece of hide was fitted into a hole in the ground and used for cooking. Rawhide bowls were also used.

Most of the meat was cut into thin strips and "jerked." Jerking meant hanging the strips on a rack in the dry wind that swept the plains. This dried meat would keep for a long while. Sometimes it was pounded with fat and dried berries and stored in containers of skin or membrane. Called pemmican, this was an excellent concentrated food for warriors or hunters on long journeys.

After following the herd until they had a good supply of meat and hides, the hunters would return to their permanent village. Among the early Plains tribes that lived in earth lodges were the Mandan, Hidatsa, Pawnee, Arikara, Omaha, and Osage. Other tribes on the eastern fringe of the plains blended the plains and woodland way of life. Among those who lived in bark- or mat-covered wigwams were the Kansa, Missouri, Iowa, Quapaw, and some of the Osage. Others, like the Caddo, Wichita, and Waco, used grass houses. These tribes grew corn and other crops and made pottery cooking vessels.

Village tribes along the Missouri used a bowl-shaped bullboat. They made it by stretching a buffalo hide over a wooden frame. It was too clumsy for water travel, but it could be used to ferry over a river.

How Horse-owning Tribes Moved About

The Plains tribes gave up permanent villages after they got horses. Among the tribes which changed were the Sioux, or Dakota, the Blackfeet, the Crow, the Cheyenne, Arapaho, Comanche, and Kiowa. Each tribe knew where the buffalo should be from month to month in the tribe's hunting ground, and the tribe moved as necessary for convenience in hunting. To get horses, the Indians traded their most valuable goods, raided the camps of white traders and other tribes, and roped any wild ponies they found. On a big hunt the many bands in a tribe gathered in a huge camp of hundreds of tepees. The tepees were much larger after the Indians had horses to haul the heavy covers on the travois.

Buffalo runs were wild, exciting affairs. Scouts located a herd; then the long line of mounted hunters

TRANSPORTING GOODS ON THE TRAVOIS

The dog travois, or drag, was all the Plains Indians had for hauling their goods before white people brought horses to America. This one has a frame to hold small bundles. This horse travois is made from tepee poles. Its load is the buffalo-hide tepee cover. A small boy rides the horse as the tribe moves camp. He has a crude saddle, though the braves usually rode bareback. This picture is from the Colorado State Museum.

rode forward. Sometimes fantastically dressed medicine men trotted ahead, chanting and shaking rattles. At a signal the hunters dashed among the buffalo at a gallop. Guiding his trained buffalo horse by knee pressure, the hunter pulled alongside his quarry and drove an arrow into its body. He gripped a pair of arrows in the left hand, which held the bow, and held another in his mouth. A quiver with spare arrows hung from his shoulder. A brave, skillful, and lucky hunter might kill four or five animals during a run.

Celebrations and Honors for Bravery

Almost as exciting as the hunt itself was the feast that followed. Happy, and filled with good red meat, the Indians would sing and dance and recite war chants. Boasting at such times was not considered bad manners. When getting ready for a hunt or a war party, or on coming back from one, a brave was expected to get up and tell how strong and courageous he had been.

No Indians honored bravery, daring, endurance, and other warlike qualities more than did the Plains hunters. They held huge religious ceremonials to rouse enthusiasm and win the help of the gods. Each tribe had its secret societies in which young men passed from rank to rank to win high honors. The men withdrew from the camp for fasting and purification to gain the vision of a guardian spirit which would give them magic powers. They painted its picture on their shields and tepees.

The tribe rewarded warriors for bravery. For a courageous deed an Indian was given the right to wear one or more feathers. Most prized were those of the eagle. They were decorated and worn as a headdress. It was in this way that the famous war bonnet came into being. Each brave kept track of his heroic deeds by "counting coup." (*Coup* is a French word meaning "stroke" or "blow.") Among the deeds which counted as coups were killing or scalping an enemy, touching a living enemy's body or an enemy tepee, and stealing a horse from an enemy.

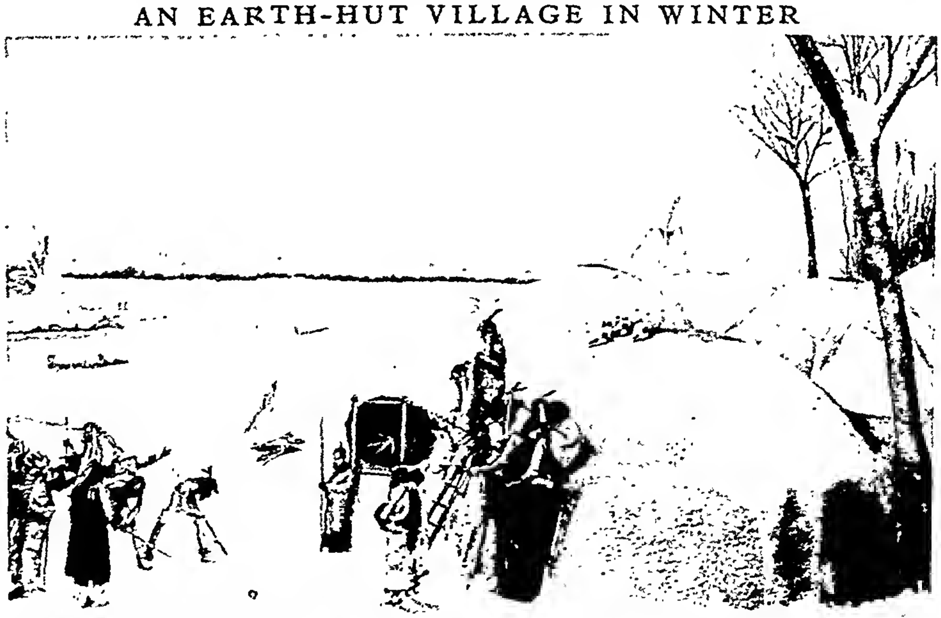
Contrasting Work of Men and Women

The exciting, glamorous life of the men makes that of the woman seem dull and hard. But there was a good reason for making the women do the work of moving camp. The men had to be armed and ready to fight at a moment's notice. Enemy raiders might appear at any time, trying to capture the precious horses. Some of the tribesmen guarded the camp. Others were scouts who rode ahead and signaled the appearance of game or enemy. Signals included riding in a certain pattern, waving a buffalo robe, sending up puffs of smoke by day, and using fire by night.

The women became so expert that they could set up the tepees or take them down in a few minutes. They packed all equipment and lashed it on the travois. The mother usually rode a horse, with the baby on its cradle-board hanging beside her.

In camp the women spent hour after hour scraping flesh and hair from the buffalo hides and tanning them.

AN EARTH-HUT VILLAGE IN WINTER



These Mandan lodges look like mounds under their blankets of snow. They were warmer than the tepees the Mandans used while hunting. In the distance dogs are pulling a loaded sledge. A bullboat leans against one hut. A ring and pole game is in progress and braves sit on the huts watching. They wrap their buffalo robes about them to keep out the cold. Some are "dressed up" in their war bonnets. This picture is from a diorama at the Milwaukee Public Museum.

From the hides they made all sorts of things—robes, bedding, rawhide utensils, and carrying cases, called parfleches. Buffalo horns were carved into spoons and ladles. The hoofs could be cooked to make glue.

When it was time to make a new tepee cover, a woman invited her friends to help with the task of sewing the big white hides together. They used the sinews along the buffalo's backbone for thread. Later the man painted his guardian animal and other designs on the tent.

The chief skill of the men lay in making weapons. They whittled bows from osage orange, or other tough wood, and shaped them in a double curve. They made arrows with a sharp stone head. They lashed feathers to the arrow butt to make it fly straight (*see* Archery). Each hunter had his own design in the feathers to show which animals he had killed in a big hunt.

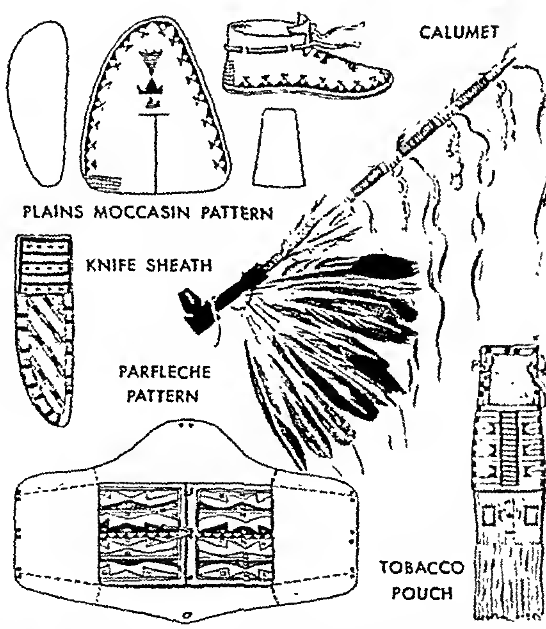
Clothing and Crafts

The women used the softer, finer skins of deer and antelope for most garments. They embroidered the ceremonial costumes with dyed porcupine quills and painted the carrying cases and the tepee linings. In the designs, they drew triangles, diamonds, and other geometrical figures.

Women's dresses and men's shirts were made of a pair of skins fastened together at the top, except for a neck opening. Often the women covered the yoke and belt of their ceremonial dresses with beads. The men wore breechcloths and thigh-length leggings in addition to shirts when they were "dressed up." The seams of their leggings ran down the sides of the leg. (The Woodland leggings had a front seam.)

Plains warriors loved ornaments. They decked themselves with trophies of war and the hunt. Locks of hair from the scalp of an enemy and soft white ermine tails dangled from the seams of the ceremonial shirt. Grizzly bear claws and buffalo teeth were strung on otter skin for necklaces. Quivers, tobacco pouches, and medicine bags were made from pelts of panthers, otter, and beaver. Eagle quills were used in their headdresses and decorated their shields, dance "bustles," ceremonial pipes, and lances. On his robes of young buffalo skin, the warrior often painted sketches showing the battles he had fought during his life.

PLAINS INDIAN ARTS



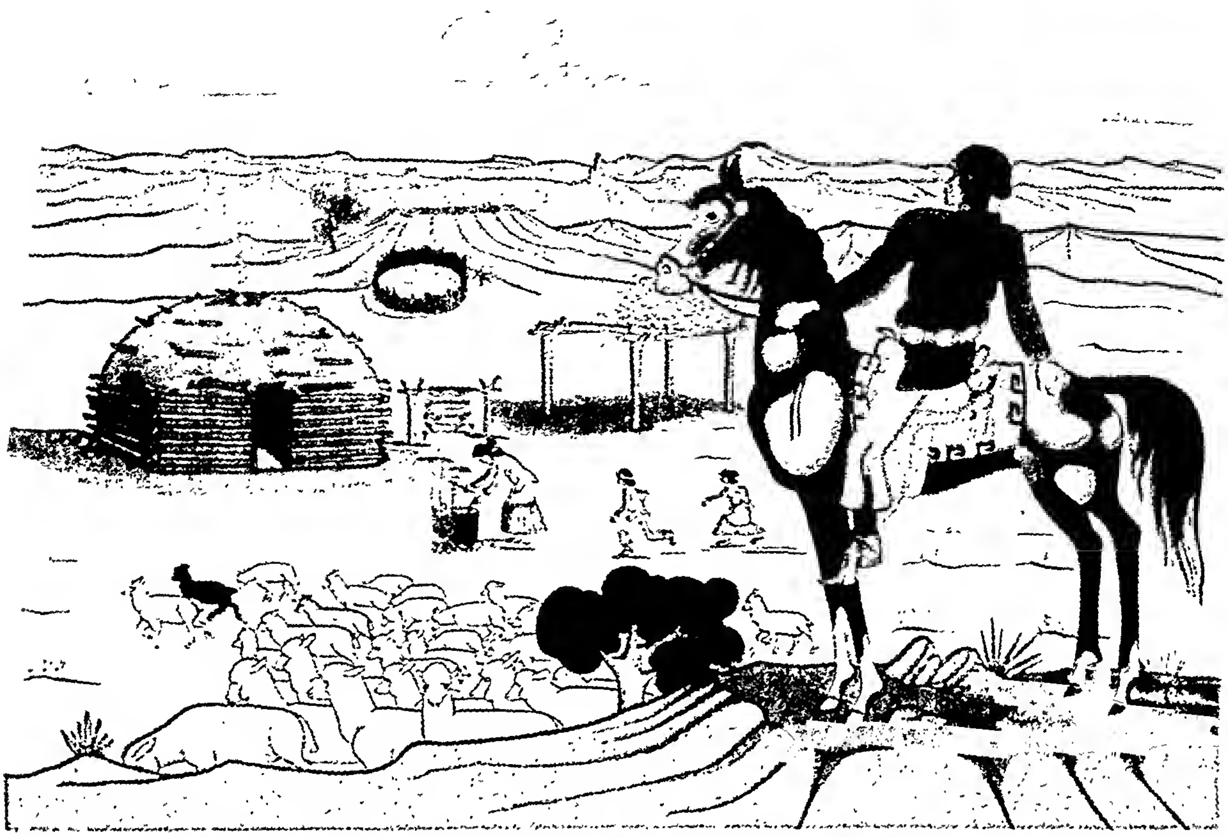
Here a Blackfeet woman is beading a moccasin. At the bottom are some beautiful things made by Plains Indians. The patterns show how to make the hard-soled Plains moccasin and how to cut and fold the leather carrying case, or parfleche. The tobacco sack and knife sheath are trimmed in porcupine quills. The calumet, or ceremonial pipe, is decorated with feathers and hair.

The braves painted their bodies for dances and for battle. Designs might be special "medicine," or magic, to protect their lives. Or they might be drawn to make the men look more ferocious. For paint, the Indians used red and white clays, black charcoal, and yellow from bullberries or moss. They first smeared their bodies with buffalo or deer fat, then rubbed on the color.

The practise of using animal grease or fish oil on the skin to clean and soften it was common among Indians. The resulting odor was frequently unpleasant to white people. An Indian method of bathing in use here and throughout the country was the sweat bath. The Indians built a special airtight hut for this purpose. Hot stones were placed in the hut and sprinkled with water to make them steam. The Indians stayed here until they were perspiring freely. Then they rushed out and plunged into a cold stream. This treatment was used for purification before ceremonials and as a cure for disease.

Love of ornament was a spur to trade among the Indians and later between Indians and whites. Shells and coral from the seacoasts, native copper from the Great Lakes region, turquoise from the Southwest, pipestone from Minnesota, and bear claws from the Rocky Mountains were passed from tribe to tribe, long before Columbus discovered America. The Plains tribes had buffalo hides and fur pelts to trade. Their region was the scene of a bitter rivalry among French, English, and American traders. The Indians here used glass beads, needles, steel knives, copper kettles, and other manufactured wares long before white settlement.

A NAVAJO FAMILY AND ITS FLOCK OF SHEEP



This painting by Gerald Nailor, a Navajo artist, catches the flavor of the Southwest landscape. The man sits proudly on his spotted pony. Beyond stand the hogan and arbor. A corral for the stock lies at the foot of a distant mesa. The wife is dyeing yarn while the children play. Mr. Nailor's Navajo name is Toh-yah, which means "walking by the river." His wife is a Pueblo woman. Her people gave him another name—Nal-tsoli, which means "yellow aspens."

Southwest Farmers and Herders

New Mexico and Arizona offer visitors an opportunity to see and study Indians following many ancient customs, activities, and ceremonials. Though the Southwest Indians have adopted many of the white man's ways and his manufactured goods, they retain many old ways, because these ways are so well suited to this dry, rugged, highland region.

Southwest Indians worked out two ways of winning a livelihood in this region—farming and herding. Farming is the older. Perhaps two thousand years ago the forefathers of the Pueblo Indians began planting corn here. Centuries before Spanish explorers found them in 1539, they had become settled villagers and could grow crops in spite of scanty rain by using irrigation. They built many-storied houses from stone and adobe clay and they were skillful at basketry, pottery making, and weaving.

Other Southwest farmers were the Pimas and Papagos of southern Arizona. Archeologists say their forefathers (called the Hohokam) built the finest irrigation systems in prehistoric North America. The Pimas and Papagos lived in simple huts with a framework of logs and poles covered with arrowweed or grass and plastered with clay. They made fine baskets.

The herding way of life did not develop until after the Spaniards introduced sheep and goats. Before this the Navajo and Apache peoples had come from the north and lived by hunting. When game was scarce, they raided the farming settlements for food.

The Navajos gradually adopted herding after they got sheep. They ceased fighting and turned entirely to herding after 1867, as a result of defeat by United States military forces. The Apaches were even slower to give up hunting and raiding, but today they are farmers and stock raisers.

Life of the Navajo Herders

The Navajos have been called *nomads* because they followed their herds from place to place seeking pasture. This does not mean that they were aimless wanderers. They followed the same route year after year because they knew where to find the best grass at each season. Each family had winter and summer homes, called *hogans*, along the route. The hogans were made of logs, earth, and rocks. At one home, the Navajo family often had a garden and a fruit orchard.

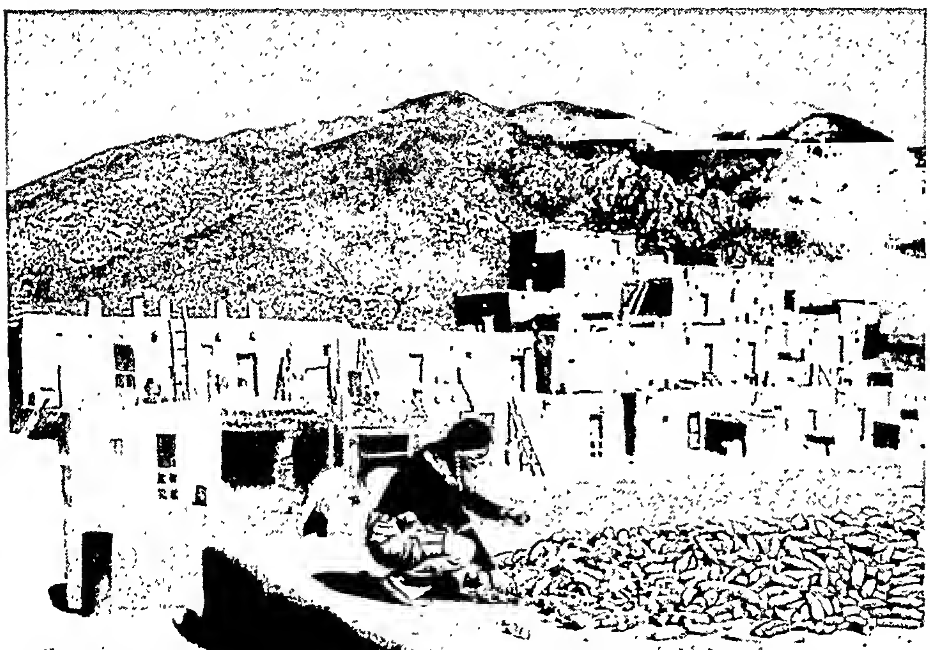
The Navajos were clever about learning the skills of their neighbors and adding improvements and individual touches. They learned weaving from the Pueblo Indians, and today Navajo blankets and rugs are

better known than Pueblo products. The women do all this, from shearing the sheep to the final weaving. (For a picture of a Navajo loom, *see* Spinning and Weaving.)

Navajo men learned silverworking from the Mexicans. They adapted designs from many sources, especially the patterns stamped on Spanish bridles and saddles. The "squash blossom" necklace was taken from the pomegranate pattern of Mexico. They set their rings, bracelets, and necklaces with turquoise stones found in the Southwest.

In their hunting days, the Navajos had worn clothing made of animal skins and plant fibers. After the white people came, the Indians copied their clothes in cloth bought from traders. Both men and women wear a velveteen blouse held in at the waist with a belt of silver disks, called *conchas*. The women's skirts are long and full. Both men and women twist their long black locks in a knot at the back, called a *chonga*. Men tie a kerchief about their heads. For warmth, they wrap a striped blanket around their shoulders.

DRYING CORN ON A ROOF AT THE TAOS PUEBLO



Here a modern Taos farmer spreads corn on his roof to dry. The section of the pueblo in the background shows how each story is set back the width of a room. On the ground stand the beehive-shaped ovens for baking wheat bread. The Spaniards taught the Pueblo folk to build them.

Villages and Houses of the Pueblo Indians

The Pueblo Indians are often thought of as one people. Actually there were many tribes among them and they spoke a variety of languages, belonging to four distinct language families. Customs also differed somewhat from place to place. Farthest west were the Hopi villages on high, flat-topped, rocky plateaus (called *mesas*) in northern Arizona. Next came the Zuñis, across the border in New Mexico. These two groups of villages are sometimes called the *desert* pueblos. This sets them apart from the *river* pueblos, strung along the Rio Grande and its tributaries in eastern New Mexico. Between lie two other pueblos, the Acoma and Laguna.

Pueblo homes had several stories and many rooms, like a city apartment house. Each family had only one room. Early ancestors of the Pueblo tribes set their buildings in caves high in canyon walls, and so they have been called Cliff Dwellers (*see* Cliff Dwellers). Later the Pueblos built these houses in the valleys and on the mesas.

To keep out enemies, they made the ground story without doors or windows. The next story was set back the width of a room, and the roof of the lower story provided a "front yard" for the people of the second story. Higher stories were set back the same way. The people used ladders to reach their apartments.

Desert peoples found sandstone they could split easily. They used slabs of it to build thick walls. River valley people made walls of earthen material, stiffened with stones and saplings. The earth contained a mixture of clay and sand that did not crack easily when dry. The Spaniards called it *adobe*. They taught the Indians to make bricks by shaping adobe in wood molds and drying it in the sun. Many modern pueblos are built of these bricks.

Roofs were harder to make. The builder had to make a trip to the mountains to bring back log rafters. He laid them on top of the walls, with the ends protruding. Next came crisscross layers of willow branches, light sticks, grass, and brush. A heavy coating of adobe was plastered on top.

Each pueblo had dark, inside rooms for storing corn, pottery, clay, wood, and sacred objects of the families and clans. Special rooms (*kivas*) were for religious purposes. Here the men taught the boys religious legends and dances, and initiated them into secret societies. Here too they purified themselves and prepared for dances and religious ceremonies. These were held in a plaza outside the pueblo. To watch the dances, people gathered on the roof "front yards." In some pueblos, a guard kept watch from the highest roof. The town crier also stood here to make announcements. On ordinary days the women used the "front yards" for making pottery and baskets and for preparing food.

How the Pueblo Indians Farmed

Since the people relied upon crops, especially corn, for their food, they located each village where it could get a supply of water for the fields. The Hopis had springs at the base of their mesas. The Rio

NAVAJO SILVERSMITH AT WORK

Here a Navajo silversmith hammers out a bit of jewelry on his small anvil, using only a few simple tools. Mexican silverworkers taught the Navajos to use these a century ago. This man uses a frying pan of coals to heat the metal and a bent rod for tongs.

Grande pueblos depended upon that river and smaller streams. Pueblo farmers knew how to locate underground moisture by watching the growth of wild plants. They placed their fields and gardens where moist spots occurred and where streams overflowed after storms. This meant that a man might have to travel eight or ten miles across the desert from home to field.

The man was the farmer among the Pueblo tribes. He had planted corn, beans, squash, cotton, and sunflowers before white men came. The Spaniards brought him wheat, chili peppers from Mexico, onions, watermelons, peaches, and apricots.

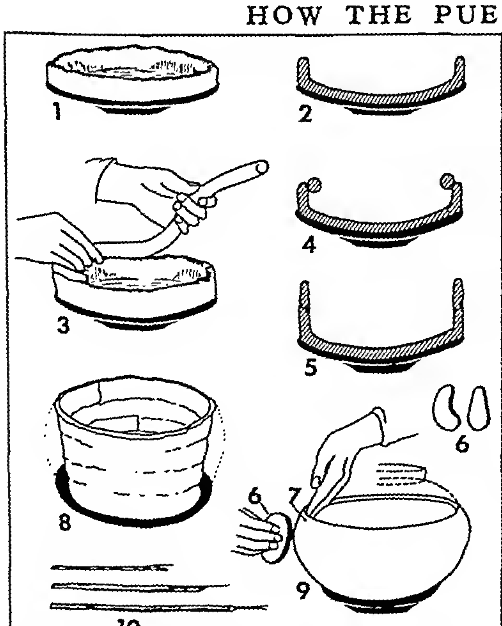
Planting, Hoeing, and Harvesting

At planting time his relatives and neighbors came to watch and help each planter. They set up prayer sticks decorated with turkey or eagle feathers to bring rain. The planter used a tough, sharp digging stick, hardened by fire. It sometimes had a branch at one side to serve as a footrest. He drove the stick into the ground 18 or 20 inches. Then he dropped in 20 kernels of corn to be sure a few sprouted. The seeds sent their roots deep to seek out the moisture. The stalks grew in a bunch that would resist the hot desert winds. The farmer scraped off the tops of the weeds with a sword-shaped wooden hoe.

Summer rain was needed for growth of the corn. Many of the religious ceremonials, therefore, were prayers to the gods for rain. After a storm, the water gushed down dry stream beds tearing away the soil. The farmers made dams of brush to check and spread the water over the land. In some places they had ditches from stream to field.

At harvest everyone had a gay time at the husking parties. Then the corn was laid to dry on the flat roof. The women cut strips of squash and hung them to dry. They pounded the dry beans with sticks to open the pods. Then they shook them in a flat basket and let the wind carry away the pods. They winnowed the wheat chaff, in the same way, after the grain was threshed by driving horses over it. They kept a two- or three-year supply of food stored so they would not get hungry if a drought came.

HOW THE PUEBLO WOMEN MAKE POTTERY



Here Maria Martinez, the noted San Ildefonso potter, is scraping and shaping a pot. The drawings show steps in pottery making. The potter first molds a lump of clay against a shallow bowl to shape the bottom (1 and 2). Then she builds up the sides by adding a coil of clay and pinching it into place (3, 4, 5, and 8). She shapes the jar by pushing the sides out gently with her left hand as the right smooths the outside with curved pieces of gourd shell (6, 7, and 9). She draws the design with yucca-leaf brushes (10).

Pueblo corn was grown in many kinds and colors—yellow, red, blue, white, purplish, and mixed. The girls and women spent three or four hours a day grinding it on the stone metates. To make the thin wafer bread, called *piki*, they spread a thin batter on an oiled stone set on stone props. A fire under the stone cooked the thin sheets quickly. Pueblo cooks also made dumplings, stews, and hominy dishes. A gruel of toasted meal, called *pinole*, was the chief beverage.

The men often held village hunts. If they were lucky they brought in deer, antelope, or rabbit for stew.

During their centuries of living together in villages the Pueblo Indians improved their skills and learned to make better things for their daily use. The women made beautiful, strong pottery—some of it handsomer than they make and sell today. Each village, and sometimes each family, had its own styles, colors, and designs. The women had been skilled at basketry since early times. They wove twigs, grass, and fibers from yucca and other tough desert plants into baskets, trays, mats, cradleboards, and sandals.

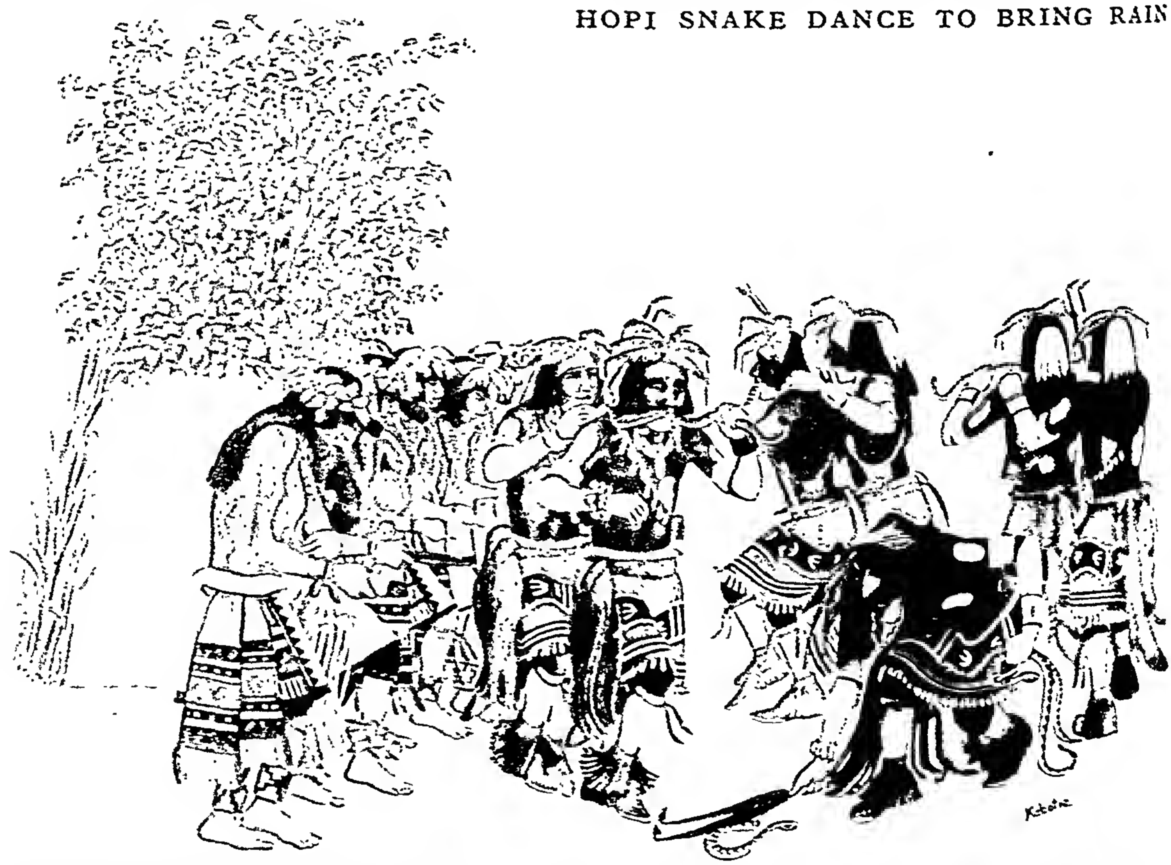
They found out how to build looms and weave cloth. The men were the weavers. They first made blankets by twining strips of rabbit skin or turkey feathers together with strings of yucca. They began raising cotton and making cloth by the 8th century A.D. They used small looms to make belts and other narrow pieces, and a blanket loom for wide strips.

The men also did the work of tanning and making moccasins and other leather goods. They made the bows and arrows, stone knives, and tools. They drilled and polished turquoise and other colored stones to make beads. After the Mexicans taught them silver-working, they created silver jewelry set with these bright stones.

Costumes for Pueblo ceremonials offer the best idea of the clothing worn before the Spaniards came. The woman's dress was a long strip of dark cloth, wrapped across the body from left to right and fastened on the right shoulder. Her left shoulder and arm were bare. A colorful, fringed belt held the garment at the waist. Her high boots were made from soft, white buckskin. Her wedding robe, or shawl, of pure white cotton was woven by the men of her husband's family as a gift.

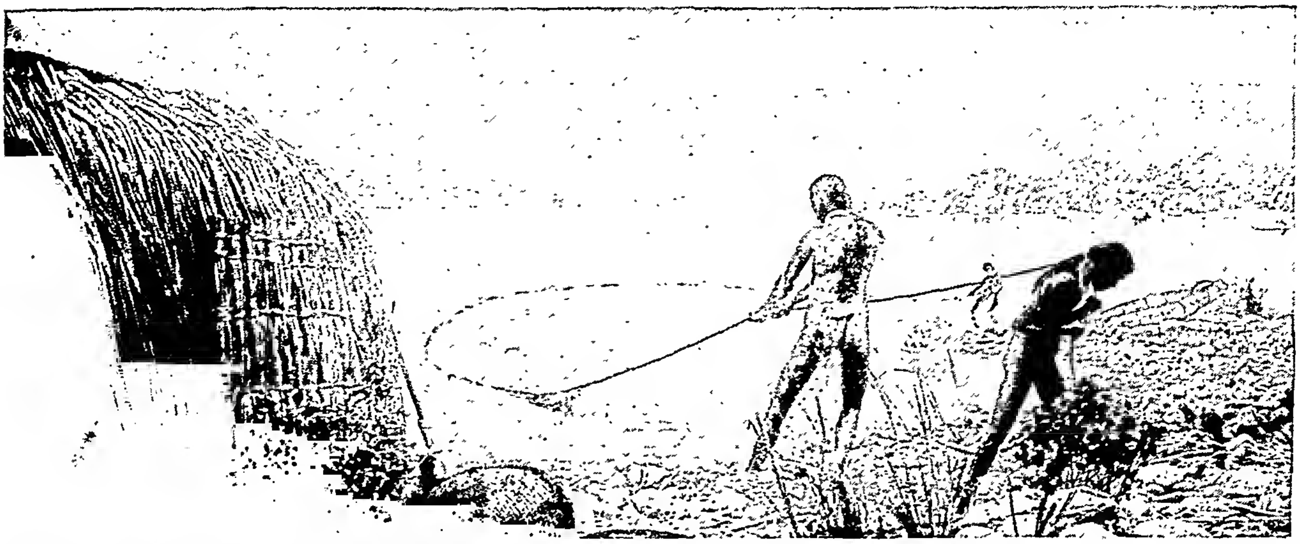
The man wore a breechcloth of white cotton cloth and a short woven kilt with a colorful border. In most pueblos, the high moccasins reached halfway up the calf of the leg. They had a hard sole turned up over the edge of the upper. Pueblo Indians near the plains wore ankle-height moccasins like those of Plains hunters. Modern clothing includes styles picked up from white people at different periods.

HOPI SNAKE DANCE TO BRING RAIN



Fred Kabotie painted this picture of the most famous ceremonial of his people, the Hopis. The Snake and Antelope secret societies perform this dance after days of secret rites in their kivas. The Antelope priests dance and shake rattles. One Snake priest takes each snake from the leaf bower and dances with it in his mouth. An attendant waves the eagle-feather "snake whip." The collector drops the snakes into a ring of sacred meal. Then the priests place them in the desert to carry prayers for rain to the gods.

POMO INDIANS SEINING FISH IN CLEAR LAKE, CALIF.



The Pomo Indians who lived in a well-watered valley of northern California had a better food supply than their neighbors in drier regions. In this diorama from the Milwaukee Public Museum, three men are hauling a net full of fish from Clear Lake. They made the net from Indian hemp, milkweed, or nettles. They beat the fibers from the stalks with a rock and rolled them on the bare thigh to make string. They used the tule stems that grew by the lake to make mats, or fringes, for covering the hut at the left. From bunches of tule they made the rough, cigar-shaped boat, or balsa, that is drawn up on the bank at the right.

California and Intermountain Seed Gatherers

ANOTHER way of living was developed by the Indians in the dry portions of southern California and in the Great Basin desert between the Rocky Mountains and the Sierra Nevada. They belonged to many tribes and spoke various languages, but their customs were quite similar. They all shared the problem of finding food in a land that would have baffled most white food seekers. Since seeds and roots were among their chief foods, these Indians have been called Seed Gatherers, and also Diggers.

The food hunt filled their days. Each group moved on foot over its range of land, seeking spring greens in one place, summer seeds in another, and autumn acorns or pine nuts in still other spots. In the winter months they camped in some sheltered valley, living on dried foods. Throughout the year they added game to their diet of seeds, roots, and nuts whenever they could get it.

They did not have summer rain or a dependable water supply. Therefore they could not grow corn or other field crops. Because they had to keep moving, seeking food, they could not live in villages.

Finding Food in the Desert

They found an amazing number of things to eat on their yearly march. Tribes of southern California used 60 different plants. It took hard work to prepare the food. To use acorns they had to crack them, pick out the kernels, pound the kernels into meal, and treat it with hot water to remove the bitter, poisonous tannin. They beat millions of tiny seeds from flowering plants and ground them into flour on a *metate*. The women made gruel from these meals and flours. They cooked it by dropping hot rocks into a tightly woven basket that held water and meal. The gruel was thick enough to be eaten in the hand.

They pried up bulbous roots of the camass lily and baked them overnight on hot rocks covered with earth. Berries, seeds, and nuts were dried for winter use.

The Seed Gatherers ate quite a few things which many people would think unpleasant. These included crickets, grasshoppers, insect larvae, ants ground into flour, and certain lizards and snakes. When bigger game was scarce hunters were glad to dig out a nest of pack rats or to trap ground squirrels, rats, or mice.

GATHERING DESERT SEEDS

This girl is picking seeds and dropping them into a cap woven like a basket. She will carry them back to camp in the cone-shaped burden basket by a tumpline around her forehead. Sometimes the Seed Gatherers beat the seeds off the bush with a wicker paddle.

The tribes in northern California and in the foothills found deer, antelope, or elk plentiful. Elsewhere rabbits supplied most of the meat. The men made fiber nets to trap them. They stretched the net across a feeding patch and drove the rabbits into it. The animals became entangled in the net and could be killed easily. A curved throwing stick was more useful than a bow and arrow in hunting rabbits, quail, and ducks.

Tribes living near the interior lakes, the salmon rivers, or the sea caught fish with nets or used spears with stone points or bone barbs. Sometimes they threw a poisonous weed into the water to stupefy the fish first.

How the Bands Traveled

Bands of relatives traveled together. Each band had its own ter-

USING A FIRE DRILL AND MAKING ACORN GRUEL

This Hupa family is preparing acorn gruel. The man at the right is twirling a stick against dry wood to make a spark for lighting a fire. The woman in the center is pounding the acorns into meal. Her pounding bowl has a stone bottom and a basketry top to keep the nuts from flying out. The woman at the left is pouring meal into a hollow in sand. The little girl brings water to be poured over the meal to wash out its poisonous tannin. At her feet are the sifting basket and the bit basket for cooking the gruel with the hot rocks. This picture is from a diorama at the United States National Museum.

ritory and if necessary would fight to keep out intruders. In the autumn, several bands might meet in the piñon forest and camp together until they had picked and eaten the nuts.

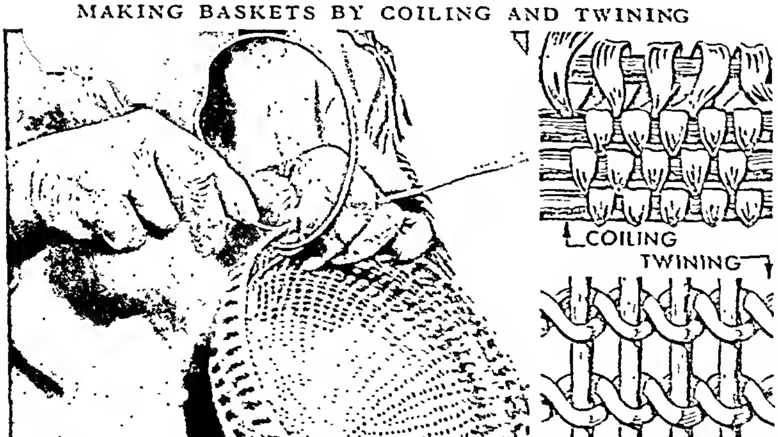
The whole tribe gathered once a year for the fall hunt. The medicine man worked his magic to make the antelope come. If the hunt was successful there was food for several days of celebration. Young and old played games all day. The older men of the various family groups made speeches. In the evening came the religious ceremonials and dances and the songs telling tribal legends.

Kinds of Shelters

The weather was hot and dry most of the year, and there was no need for substantial shelter. Sometimes campers in the Great Basin would throw together a windbreak of sagebrush. At times a family would set up a rough frame of boughs and cover it with twigs and brush. Scattered marshy places in the basins and valleys grew cattails and bulrushes, called *tule*. Mats, or fringes, made from their stems were used to cover some houses. Bundles of long, coarse grass were used like shingles on others. Usually the builders dug a pit about two feet deep under the house. This saved wall building and served to keep drafts off the floor. The women wove rough storage baskets of twigs and set them up on platforms to keep animals out of their store of seeds.

For the winter camp, the Indians of southern California heaped earth over the huts to make them warm. The tribes of northern California could get redwood and split it with wedges of elk or deer antlers. They tied these slabs to frames and built better houses than tribes to the east or south made.

MAKING BASKETS BY COILING AND TWINING



Seed Gatherer women made baskets by coiling (top sketch and picture) and by twining. In coiling, the foundation is a long rope of grass or twigs. It is wound in circles and sewed together by pushing fiber through it with an awl. In twining, stiff foundation sticks are set like umbrella ribs. The filling is woven in and out among them.

Scanty Clothing or None at All

In the hot, dry climate there was little need for clothing. Children wore none at all. Men usually went unclad, though they might wear breechcloths if they had deerskin or rabbit fur to make them. The women made fringed double aprons from fibers of sagebrush bark, milkweed, or Indian hemp.

Both men and women tattooed designs on their skins. Stripes on the chin were especially fashionable among the women. These marks were tattooed on a girl's chin as part of the ceremony celebrating her "coming of age." Necklaces and

earrings were made of bones, deer hoofs, berries, and shells brought from the Pacific coast.

Thick sandals for travel were made of yucca fiber. People who could get hides wore moccasins. Tribes that had buckskin learned to make clothing similar to that of the Plains Indians. In winter, a man was lucky if he had a furry pelt to wrap around his shoulders, or several skins tied together with thongs. In some tribes, the old men found time to twine blankets from strips of rabbit skin.

The Seed Gatherers found baskets ideal as containers during their constant moving. They were light and not easily broken like pottery. The Seed Gatherer women wove them so closely that they would hold tiny seeds and even water. There was a basket for every use—from the big gathering basket slung by a net over the forehead, to bottle-shaped water jars, covered with pine pitch to keep them from leaking. Cradleboards were made of wickerwork. In some tribes women wore caps of basketry. The baskets were beautiful, with graceful shapes and designs in color (*see* Baskets).

Life of the Northwest Fishermen

THE TOWERING forests of the rain-swept north Pacific coast contrast sharply with the dry, brown hills and rocky wastes of the Seed Gatherers' region. The contrast in the Indian life of the two regions was just as striking.

The Seed Gatherers had to work hard every day to get enough to eat. A few baskets and a scanty store of dried seeds or acorns made up their worldly goods. The Northwest Fishermen could get a wealth of food from the sea, the rivers, and the forests. They had good materials for making houses, boats, and tools. As they added possessions they began to honor wealth and family prestige. Prominent families erected totem-pole monuments to call attention to their achievements. They kept war captives and other persons as slaves. The greatest honor came when a man gave away wealth at a great feast called a *potlatch*.

INSIDE A NOOTKA SLAB HOUSE

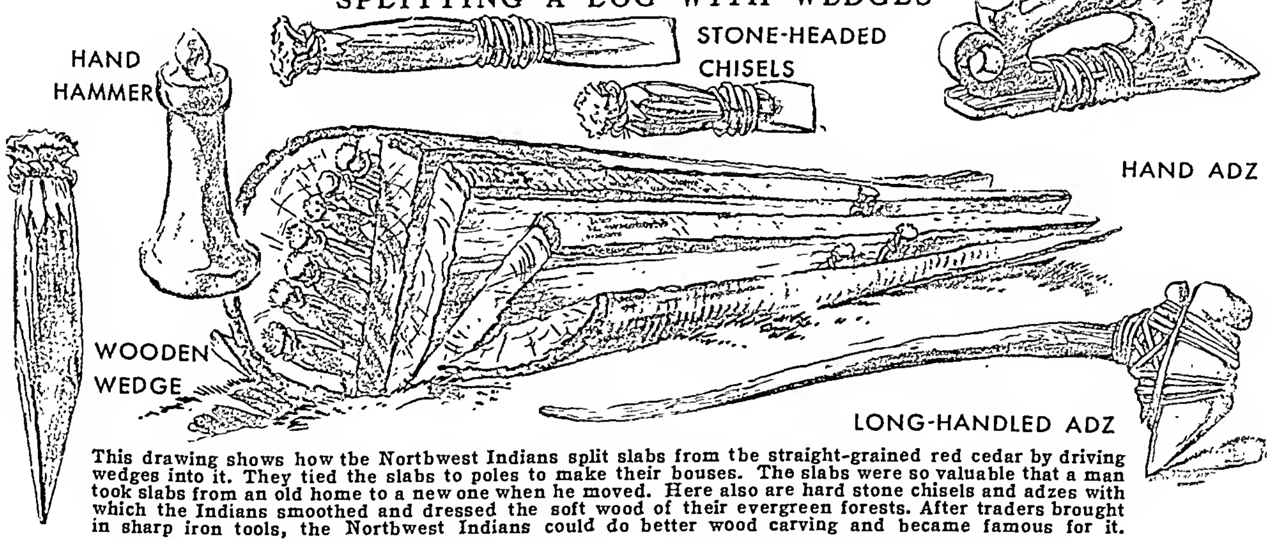
This miniature diorama from Southwest Museum shows a slab house of the Northwest, with its carved house post. The women wear fringe skirts and capes made from the inner bark of the cedar tree. They are weaving, making baskets, and broiling fish. Notice the fish hung on the rafters to dry and smoke.

Since wandering Seed Gatherers seldom met other people, they had no definite political organization. Among the Northwest tribes, powerful hereditary chiefs or headmen controlled and distributed hunting and fishing rights. Among the Haida, society had three grades—aristocrats, commoners, and slaves.

The Sea's Gifts to the Northwest Tribes

The various tribes along the coast from northern California to southern Alaska had no pressing food

SPLITTING A LOG WITH WEDGES



This drawing shows how the Northwest Indians split slabs from the straight-grained red cedar by driving wedges into it. They tied the slabs to poles to make their houses. The slabs were so valuable that a man took slabs from an old home to a new one when he moved. Here also are hard stone chisels and adzes with which the Indians smoothed and dressed the soft wood of their evergreen forests. After traders brought in sharp iron tools, the Northwest Indians could do better wood carving and became famous for it.

problems. They could get plenty of fish, shellfish, and even whales, seals, and porpoises, from the sea and streams. They became expert fishermen. The men built weirs and traps to catch huge hauls of salmon and candlefish as they swam up the rivers to spawn.

The women smoked a year's supply of salmon and pressed the oil from the candlefish. The Indians used large amounts of this oil, dipping dried foods into it at meals. They dug clams along the beach and smoked them. The lovely shells of some varieties of shellfish made ornaments. Strings of shells served as money in some tribes just as wampum was used among Eastern Woodland Indians.

Whaling was difficult and dangerous, and the leader of the hunt performed elaborate ceremonials to get help from the spirits. Each of the men in the big seagoing dugout canoe was trained for his special task. Success brought wealth, honor, and feasting. The whale's flesh and skin were eaten. The blubber made oil, the intestines were used as oil containers, and the sinew became strong rope.

The men journeyed to the mountains to hunt deer, elk, mountain goat, and bear for hides and meat. The women collected and dried berries and seaweed, and dug camass bulbs and roots to vary the fish diet. By winter the people had an ample store of food on hand. They could spend much of their time at festivals, ceremonials, secret society initiations, wood carving, and other activities.

A POTLATCH IN A PACIFIC COAST VILLAGE

Here a wealthy man has called together his friends for a "give-away party," called a *potlatch*. After much feasting, singing, and dancing, the host gave away blankets and other valuable gifts. Men who received gifts were expected to return even richer gifts at another potlatch. Thus the first host established credit for the future.

Gifts of the Great Forests

The Northwest tribes made greater use of their trees than the Eastern Woodland Indians. Their evergreen timber was easier to work than the eastern hardwoods. They knew how to split slabs from the straight-grained red cedar and how to use them to build barnlike houses. They girdled the trees with fire and let them season a few years before felling.

The boatbuilders hollowed logs with fire to make the small canoes they paddled in the streams and the big seagoing canoes of the whalers. Other woodworkers steamed and bent planks to make boxes, tying the edges together with spruce roots. These boxes were built to hold the huge winter stores of dried food and were even used for hot-rock cooking.

Aprons, Raincoats, and Hats from Inner Bark

The inner bark of the cedar served as raw material for garments and beautifully woven baskets. The women pounded the bark into shreds and made fringed

NORTHWEST FISHERMEN HARPOONING A MAMMOTH WHALE

Here several canoes of whalers close in on a giant whale so the harpooners can throw their weapons. The barbed point of the harpoon is tied by a whale-sinew rope to a sealskin float. With the barb in its flesh, the wounded whale had to drag the float and canoe through the water—perhaps for several days. When the animal tired, the whalers killed it with sharp lances. The carved designs on the canoes carried magic to aid the whalers. Pictures on this page are from the Milwaukee Public Museum.

aprons for themselves and raincoats for the men. They wove a cedar-fiber man's hat with a brim to shed the heavy rains.

The children and men went without clothing in the summer. These Indians got along without moccasins, perhaps because they did most of their traveling by canoe. Winter garb included a robe of sea-otter skins or a blanket. The women used cedar-bark fiber, mountain-goat wool, dogs' hair, and feathers in the blankets. Their crude loom had only one crosspiece. The weavers worked out intricate patterns in various colors entirely with their fingers. The handsomest blankets were made by the Chilkat Tlingits.

Like tribes of other regions, these Indians adopted manufactured blankets after white traders reached the region. But the trade blankets were too dull to suit the taste of Northwest folk, so they trimmed them with rows of pearl buttons.

The Northwest people tattooed their skins and deformed their heads to look "pretty." The top of a baby's cradleboard was so attached that it pressed a pad of cedar bark against the baby's forehead, causing the head to rise in a peak. This deformed skull was the sign of a freeman. Slaves were not permitted to flatten their heads.

Wood carving was the outstanding art of the Northwest. The artists carved grotesque faces of animals, birds, and people on boxes, house fronts, house posts, boats, and grave posts. They made wooden helmets and masks for the ceremonial dances and dramatic performances. They often painted the carved designs.

Totem Poles of Alaska and British Columbia

Most spectacular of the art works was the totem pole. These tall, carved posts were erected by important men among certain tribes of British Columbia and Alaska. The carved and painted faces on them represented the owner's totem animals or birds. These animals were his mythical ancestors who gave him power in war, hunting, or whaling. The designs were carved to represent human and animal faces rather than to look exactly like them. So each figure bore a symbol of some sort to identify it. Erect ears distinguished an animal from a man. The killer whale always had a protruding dorsal fin, and the eagle, a curved beak.

Northwest craftsmen also had some native copper to work with. They made some of their arrow points from it as well as copper knives for weapons in war. They engraved designs on a plaque, called a "copper," that served in the place of a valuable bank note. A famous copper was valued at 7,500 blankets.

Tribes and Languages among the Indians

WHEN white explorers and settlers first came to North America, there were not many Indians on the continent—perhaps 1,025,000 north of Mexico. This amounts roughly to an average of one person for every seven square miles of land; but this figure is only an average. The land was most densely populated in the southwestern homelands of the Pueblo Indians. The forested portions of the Atlantic and Pacific coasts had denser populations than did the interior plains or the Arctic North.

Some early explorers and settlers thought of the Indians as a single people. But the Indians themselves did not. An Indian considered himself a Delaware, a Seneca, a Huron, a Sioux, or a Navajo. He did not think of himself as an Indian. The name of many of the tribes meant "the people" in the tribe's language. Members of other tribes were considered foreigners and often enemies.

Variations in Indian Languages

The separation into small groups was emphasized by differences in language. The Indians of North America spoke approximately 600 dialects in many different languages, or several times as many as are spoken in Europe. Often the differences were great enough to hamper or prevent understanding when an Indian had gone only a short distance from home. These differences in speech also handicapped white explorers in getting information from the Indians. When Lewis and Clark met the Flathead Indians in 1805, their questions had to be interpreted through six different languages before the Flatheads understood.

Both Indians and white traders tried to overcome language difficulties by creating *trade* languages. They were made of words from Indian and European languages. Among them were the Chinook trade language of the Northwest and the Mobilian of the Southeast.

Indians of the Great Plains worked out a sign language for communicating with each other. They could

SIOUX AND HOPI TALK WITH SIGNS

The modern Plains Indian, at left, uses the sign which means "house" or "to stay in one place" as he talks with a lad from the Southwest. Plains Indians devised hand signs to communicate with strange tribes they met on their long hunting journeys.

WHERE SETTLERS FOUND THE CHIEF TRIBES

The tribes named on this map were chosen on the basis of size and importance in American history. Those shown in large type had more than 10,000 members in early times. The map location shows where each tribe lived when English-speaking settlers reached its area rather than where the tribes were at any one time. Those east of the Mississippi are placed where they lived between 1600 and 1800. Western tribes are shown in 19th-century locations. The colors on the map indicate the culture areas of North America and serve as guides to the culture, or way of life, of tribes in each area.

convey a great deal of information with hand gestures. Some of the gestures were so graphic they could be understood by persons who did not know the signs.

The Multitude of Tribes in North America

As a rule, the groups which felt themselves to be one people were extremely small. An Indian gave his loyalty first of all to his own village or hunting group. In most parts of the continent, such a group might have less than 50 adults. Neighboring village groups might act together in war and exchange other help if they spoke the same language and if their hunting ground provided enough for all. This larger group could be called a *tribe.*

The map on this page shows the larger and more important tribes in the localities where English-speaking explorers and settlers first found them. But a multitude of smaller tribes with less than 2,000 people lived among the larger ones. Only about 10 per cent of all the tribes are named on the map, but they included about two-thirds of the total population.

Rich Vocabularies and Exact Meanings

North American Indian languages are rich in words and intricate in structure. Their vocabularies differ with the need for words to convey important distinctions in meaning. For instance, the Eskimos in the Arctic have words to distinguish many kinds of snow. One word means "snow on the ground"; another means "falling snow"; a third, "drifting snow"; and a fourth, "a snowdrift." Similarly the Plains horsemen used many words to describe horses.

PRINCIPAL TRIBES IN UNITED STATES AND CANADA

*M-Y—Mackenzie-Yukon. †C-I-S-G—California and Intermountain Seed Gatherers.

Tribe	Culture Group	Language	Early Population	Earliest Known Locality	Present Locality
ABNAKI	E. Woodland	Algonquian	3,800	Me.	Me.
ALEUT	Eskimo	Aleut	16,000	Aleutian Islands, Unalaska	Aleutian Islands, Unalaska
ALGONQUIN and OTTAWA	E. Woodland	Algonquian	7,000	Quebec	Ontario, Quebec
APACHE	Plains-Southwest (Mixed)	Athabascan	7,000	Colo., Kan., N. M. Driven southward by Comanche in 18th century.	Ariz., N. M., Okla.
ARAPAHO	Plains	Algonquian	3,000	Colo., Wyo.	Wyo., Okla.
ASSINIBOIN	Plains	Siouan	10,000	Manitoba, Minn.	Mont., Alberta, Saskatchewan
BEAVER	M-Y Basin*	Athabascan	1,200	Alberta	Alberta
BEOTHUK	E. Woodland	Beothuk	500	Newfoundland	(Extinct)
BLACKFEET	Plains	Algonquian	15,000	Alberta, Saskatchewan. Moved southwestward 18th to 19th centuries.	Mont., Alberta
CADDO	E. Woodland-Plains (Mixed)	Caddoan	8,000	La., Ark., Tex., Okla.	Okla.
CALUSA	E. Woodland	Muskogean (?)	3,000	Fla.	(Extinct)
CATAWBA	E. Woodland	Siouan	5,000	N. C. and S. C.	S. C.
CHEROKEE	E. Woodland	Iroquoian	22,000	Tenn., N. C. and S. C.	Okla., N. C.
CHEYENNE	Plains	Algonquian	3,500	N. D., S. D.	Mont., Okla.
CHICKASAW	E. Woodland	Muskogean	5,000	Miss.	Okla.
CHINOOK	N.W. Fishermen	Chinookan	22,000	Wash., Ore.	Ore.
CHIPEWYAN	M-Y Basin*	Athabascan	2,250	Manitoba, Saskatchewan, Northwest Territories	Northwest Territories, Alberta
CHIPPEWA (*see* Ojibwa)					
CHOCTAW	E. Woodland	Muskogean	15,000	Miss., Ala.	Okla., Miss.
CHUMASH	C-I-S-G†	Chumashan	10,000	Calif.	Calif. (nearly extinct)
COMANCHE	Plains	Uto-Aztecan	7,000	Tex., Okla.	Okla.
CREE:					
Plains	Plains	Algonquian	3,000	Manitoba, Saskatchewan	Manitoba, Saskatchewan, Alberta, Mont.
Woodland	E. Woodland	Algonquian	17,000	Manitoba, Ontario, Quebec	Manitoba, Ontario, Quebec
CREEK	E. Woodland	Muskogean	12,000	Ga., Ala.	Okla.
CROW	Plains	Siouan	4,000	Mont., Wyo.	Mont.
DAKOTA (popularly known as "Sioux"):					
Teton	Plains	Siouan	10,000	Minn. Moved westward in 18th century.	N. D. and S. D.
Eastern Santee Yankton Yanktonai	E. Woodland-Plains (Mixed)	Siouan	15,000	Minn., Wis.	N D., Mont., Neb., S. D.
DELAWARE	E. Woodland	Algonquian	8,000	N. J., Pa., Del. After 1751 moved successively to O., Ind., Mo., Tex., Kan., Okla.	Okla., Wis., Ontario
DOGRIB	M-Y Basin*	Athabascan	1,250	Northwest Territories	Northwest Territories
ERIE	E. Woodland	Iroquoian	4,000	Pa., O., N. Y.	Okla. (absorbed by Seneca)
ESKIMO	Eskimo	Eskimo	89,000	Alaska, Canada, Greenland	Alaska, Canada, Greenland
HAIDA	N.W. Fishermen	Haida	9,800	British Columbia	British Columbia, Alaska
HURON	E. Woodland	Iroquoian	20,000	Ontario	Quebec
ILLINOIS	E. Woodland	Algonquian	9,500	Ill., Wis., Ia., Mo.	Okla. (under name of Peoria)
IROQUOIS:	E. Woodland	Iroquoian	10,000		
Cayuga				N. Y.	Ontario, N. Y.
Mohawk				N. Y., Quebec	Ontario, Quebec
Oneida				N. Y.	N. Y., Ontario, Wis.
Onondaga				N. Y.	N. Y., Ontario
Seneca				N. Y.	N. Y., Pa., Okla.
Tuscarora	E. Woodland	Iroquoian	5,000	N. C. Joined Iroquois in N. Y. after 1713.	N. Y., Ontario
KARANKAWA	E. Woodland-Plains (Mixed)	Karankawa	2,800	Tex.	(Extinct)
KHOTANA	M-Y Basin*	Athabascan	4,500	Alaska	Alaska
KIOWA	Plains	Kiowa	2,000	S. D.	Okla.
KUTCHIN	M-Y Basin*	Athabascan	4,600	Yukon Territory, Alaska	Yukon Territory, Alaska
KWAKIUTL	N.W. Fishermen	Wakashan	4,600	British Columbia	British Columbia
MANDAN	Plains	Siouan	4,600	N. D.	N. D.
MASSACHUSET	E. Woodland	Algonquian	13,600	Mass.	(Extinct)
MENOMINEE	E. Woodland	Algonquian	3,000	Wis.	Wis.
MIAMI	E. Woodland	Algonquian	4,500	Wis., Mich., Ill., Ind., Ohio	Ind., Okla.
MICMAC	E. Woodland	Algonquian	3,500	Nova Scotia, New Brunswick	Nova Scotia, New Brunswick, Quebec
MIWOK	C-I-S-G†	Miwok	12,000	Calif.	Calif.
MOJAVE	C-I-S-G†	Yuman	3,000	Ariz., Calif.	Ariz.
MONTAGNAIS NASKAPI	E Woodland	Algonquian	5,500	Quebec	Quebec
NATCHEZ	E. Woodland	Muskogean	4,000	Miss.	(Extinct)
NAVAJO	S.W. Herders	Athabascan	8,000	N. M.	Ariz., N. M., Utah

PRINCIPAL TRIBES IN THE UNITED STATES AND CANADA (*Concluded*)

*M-Y—Mackenzie-Yukon. †C-I-S-G—California and Intermountain Seed Gatherers.

Tribe	Culture Group	Language	Early Population	Earliest Known Locality	Present Locality
NEZ PERCÉ	Plains (Mixed)	Sahaptan	4,000	Ida., Wash., Ore.	Ida.
NOOTKA	N.W. Fishermen	Wakashan	6,000	British Columbia	British Columbia
OJIBWA	E. Woodland	Algonquian	35,000	Wis., Minn., Ontario	Minn., Wis., Mich., N. D., Mont., Ontario
OSAGE	Plains	Siouan	6,000	Mo., Kan.	Okla.
PAIUTE:					
Southern	C-I-S-G†	Uto-Aztecan	2,500	Nev., Utah	Nev., Utah
Northern	C-I-S-G†	Uto-Aztecan	2,500	Nev., Calif., Ore.	Nev.
PAPAGO	S.W. Farmers	Uto-Aztecan	6,600	Ariz.	Ariz.
PAWNEE	Plains	Caddoan	10,000	Neb., Kan.	Okla.
PEQUOT	E. Woodland	Algonquian	2,000	Conn.	Conn.
PIMA	S.W. Farmers	Uto-Aztecan	4,000	Ariz.	Ariz.
POMO	C-I-S-G†	Pomo	8,000	Calif.	Calif.
POTAWATOMI	E. Woodland	Algonquian	4,000	Mich. Moved southward to Ill. before 1700; westward after 1836.	Kan., Okla., Wis.
POWHATAN	E. Woodland	Algonquian	9,000	Va.	Va. (unorganized remnants)
PUEBLO:					
Hopi	S.W. Farmers	Uto-Aztecan	2,800	Ariz.	Ariz.
Zuñi	S.W. Farmers	Zuñi	2,500	N. M.	N. M.
Rio Grande Pueblos	S.W. Farmers	Keresan Tanoan	28,500	N. M.	N. M.
SAUK and FOX	E. Woodland	Algonquian	6,500	Wis.	Okla., Ia.
SEKANI	M-Y Basin*	Athabascan	3,200	British Columbia, Alberta	British Columbia
SEMINOLE (historic offshoot of the Creek)					Okla., Fla.
SHASTA	C-I-S-G†	Shasta	3,000	Calif.	Calif.
SHAWNEE	E. Woodland	Algonquian	2,000	Ky. Some moved to Ga. before 1681; others to Pa., O., Ind., and Mo. in 18th century; later to Kan., Okla.	Okla.
SHOSHONE:					
Wind River	Plains (Mixed)	Uto-Aztecan	2,500	Wyo.	Wyo.
Northern	Plains (Mixed)	Uto-Aztecan	3,000	Mont., Ida.	Ida.
Western	C-I-S-G†	Uto-Aztecan	2,500	Nev., Utah	Nev.
SHUSWAP	N.W. Fishermen	Salishan	5,300	British Columbia	British Columbia
SIOUX (*see* Dakota)					
SLAVE	M-Y Basin*	Athabascan	1,200	Northwest Territories, British Columbia, Alberta	Northwest Territories, Alberta
TIMUCUA	E. Woodland	Muskogean	10,000	Fla.	(Extinct)
TLINGIT	N.W. Fishermen	Tlingit	10,000	Alaska	Alaska
TSIMSHIAN	N.W. Fishermen	Tsimshian	3,500	British Columbia	British Columbia, Alaska
UTE	Plains (Mixed)	Uto-Aztecan	4,500	Utah, Colo., N. M.	Utah, Colo.
WICHITA	Plains	Caddoan	3,200	Kan., Okla.	Okla.
WINNEBAGO	E. Woodland	Siouan	3,800	Wis. Some moved to Ia., Minn., and Neb. in middle 19th century.	Wis., Neb.
YAKIMA	N.W. Fishermen (Mixed)	Sahaptan	3,000	Wash., Ore.	Wash.
YOKUTS	C-I-S-G†	Yokuts	18,000	Calif.	Calif.

Indians have been particularly good at coining names for articles introduced among them by white traders. A literal translation of the Blackfeet name for pork is "squealing meat," and their name for candy is "long white man berries."

On the other hand, the white settlers adopted many Indian words, and they have remained in the English language. Everyone is familiar with hundreds of Indian place names on the map. Twenty-six states, innumerable counties, cities, and towns, and most of the longer rivers and larger lakes bear names from Indian tongues. It has been estimated that at least 300 other words have been contributed to American speech by various Indian languages.

Indian languages may employ sounds not used in English while omitting some sounds common in that language. Many Indian languages combine into a single word ideas which would require an entire sentence in English. (This construction is called "polysynthetic.") Indian languages have grammatical structures which differ greatly from those of English. For example, some languages have no masculine or feminine genders, although they may classify nouns as either animate or inanimate. Many languages do not distinguish between singular and plural.

Language Relationships and Families

Scholars have studied the Indian languages, seeking to find relationships between them. In 1891 Maj. J. W. Powell of the Bureau of American Ethnology classified the languages spoken by the tribes north of Mexico into some 56 distinct stocks, or language families. He did this by comparing the vocabularies that had been collected by traders, missionaries, officials, and interested students.

He grouped those tribes with markedly similar vocabularies into language families, and he made a map showing their geographical location. In naming each language family he generally selected the native name of an important group known to speak that language, and added to the name the ending *an*. Thus the name

PUEBLO WOMAN
This San Ildefonso woman's "terrace haircut" makes her delicate features look broader. Notice the prominent cheekbones common among Indians.

Caddoan language is derived from the Caddo tribe, and Iroquoian from the Iroquois.

The fact that two languages or dialects were placed in the same language family did not mean that persons speaking one of these dialects could understand the other. For example, many tribes of the Central Plains spoke dialects of the Siouan language. But members of one tribe could seldom understand the speech of their neighbors.

Later studies have revealed far-reaching resemblances among language families which Major Powell considered to be distinct. These resemblances were found in the sounds used and in the methods of expressing ideas as well as in the vocabularies. In recent years some linguists have suggested the reduction of North American languages to six primary stocks. These are:

1. Eskimo and Aleut, of the Far North.
2. Algonquian and related languages, spoken by many tribes of the Eastern Woodlands, the Blackfect and Cheyenne of the Plains, and the Salish and neighboring tribes of the Far West.
3. Athabascan and related languages, used by all the tribes of the Mackenzie-Yukon Basin, by the Navajos and Apaches, and by some west coastal people.
4. Uto-Aztecan and related languages, of the Shoshonean tribes in the Great Basin and Rocky Mountain area, the Kiowas of the Plains, the majority of the Pueblos, and the Aztecs of Mexico.
5. The Chinookan and related languages spoken by a number of scattered far western tribes.
6. Siouan and related languages, including the tongues of such widely separated peoples as the Iroquois of the northeast, the Creeks and their neighbors in the southeast, the Sioux and Caddo of the Plains, the Keresan Pueblos, and the Pomo of northern California.

BLACKFEET HUNTER
This man has the tall, rangy figure of a typical Plains brave. These sculptures were made by Malvina Hoffman for the Chicago Natural History Museum.

Presumably the languages of the same primary stock are historically related and may have been descended from a common language. But scholars have not yet been able to trace in detail the lines of descent or to locate regions in which any ancestral language originated.

NAVAJO MAN
Navajo men may resemble their tall, strong-featured Athabascan relatives or the slighter Pueblos with whom they intermarried after coming to the Southwest.

Indians north of the Rio Grande had no written language. They managed, however, to keep alive traditions of important events and many beautiful folk tales by handing them down by word of mouth. Some of the tales in this "oral literature" were passed from tribe to tribe, translated into many Indian tongues.

Picture writing helped to aid memory and to communicate ideas. On the plains, a sort of calendar known as a "winter count" was kept in the form of a series of pictures painted on buffalo robes. A picture of a memorable event was selected to represent each year. Widely scattered over the continent are picture writings painted or pecked on rock cliffs, on the walls of caves, and on huge boulders. Though the meanings of these petroglyphs are not known, the pictures doubtless carried a message when they were made.

Differences in Appearance

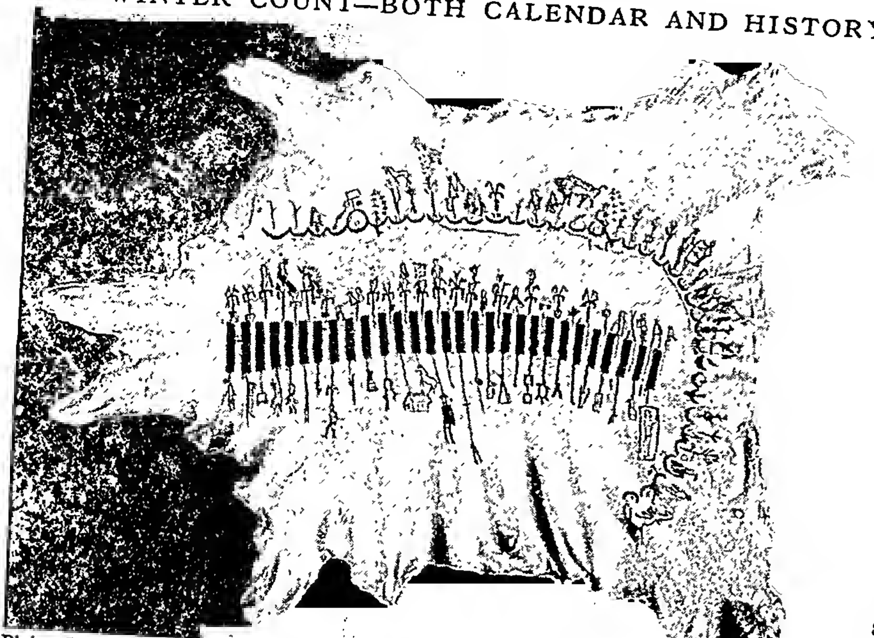
Certain racial characteristics are shared by nearly all pure-blood Indians. They generally have straight, black hair. Their skin color ranges from yellow-brown to red-brown. Their cheek-bones are usually more prominent than those of whites or Negroes. These characteristics are more closely related to those of the Mongoloids of Asia than to any other of the world's folk.

In other features there is great variety among Indians. There are great differences in shape of head (relative proportions of length, width, and height), in prominence of the jaw, in size and shape of the nose, and in total standing height.

SIOUX BRAVE
Here are the clear-cut features, sloping forehead, bold nose, and firm, heavy jaw which were commonly seen among Plains Indians.

The heads of the Plains Indians resemble the Indian head appearing on the reverse side of the buffalo nickel. Their clear-cut features are generally marked by a sloping forehead, a bold nose, thin lips, and a firm, heavy jaw. They tend to be tall.

THE WINTER COUNT—BOTH CALENDAR AND HISTORY



Plains Indians drew sketches, or pictographs, on buffalo hides to keep historic records. This Kiowa winter count indicates "moons" (lunar months) from August 1889 to July 1892 by crescents. The black strips indicate the winters from 1865 to 1892. Among the sketches of events is a building representing Fort Sill. Kiowa prisoners were taken there in 1875.

The Eskimo of the Arctic generally has a yellowish skin tone and a flat, fat face, with a short, spreading nose. He is short and sturdy. The Pueblo Indians are generally shorter than the Plains people and possess more delicate features.

Anthropologists study these differences in efforts to trace common ancestries. Since combinations of head shape, stature, and features tend to occur in certain regions it may be that America was populated by a series of peoples who differed in appearance and came in widely spaced migrations. It is known that the Eskimos were relatively late arrivals. Long-headed skulls were found among remains of early folk. Some scholars say that environmental influences (as in diet and climate) may lie at the root of regional differences.

Indian Religion, Government, and Social Practises

LIKE men of all races who live close to nature, the Indians were concerned largely with problems of day-to-day living. They were interested mostly in whether food would be sufficient, whether members of the tribe would avoid illness, and whether they would be successful in war. They gave little thought to reward or punishment after death.

Indians believed in a supernatural force which pervaded all nature. To the Algonquin, this force was *Mánito*. The Iroquois called it *Orenda*, and the Dakota, *Wákanda*. Indians also thought that animals, plants, rocks, the sun, the winds, and other natural objects had spirits (or souls) just like men. These spirits helped those they liked and injured those who offended them. Indians therefore tried to win their good will.

Ceremonials

When an Indian faced a critical problem or decision, he sought help from the spirit forces. To make himself worthy of help, he cleansed himself, fasted, prayed, and sometimes underwent severe tortures. He usually sought for a vision in some solitary place. If he was successful, a friendly spirit appeared in the vision and promised him aid.

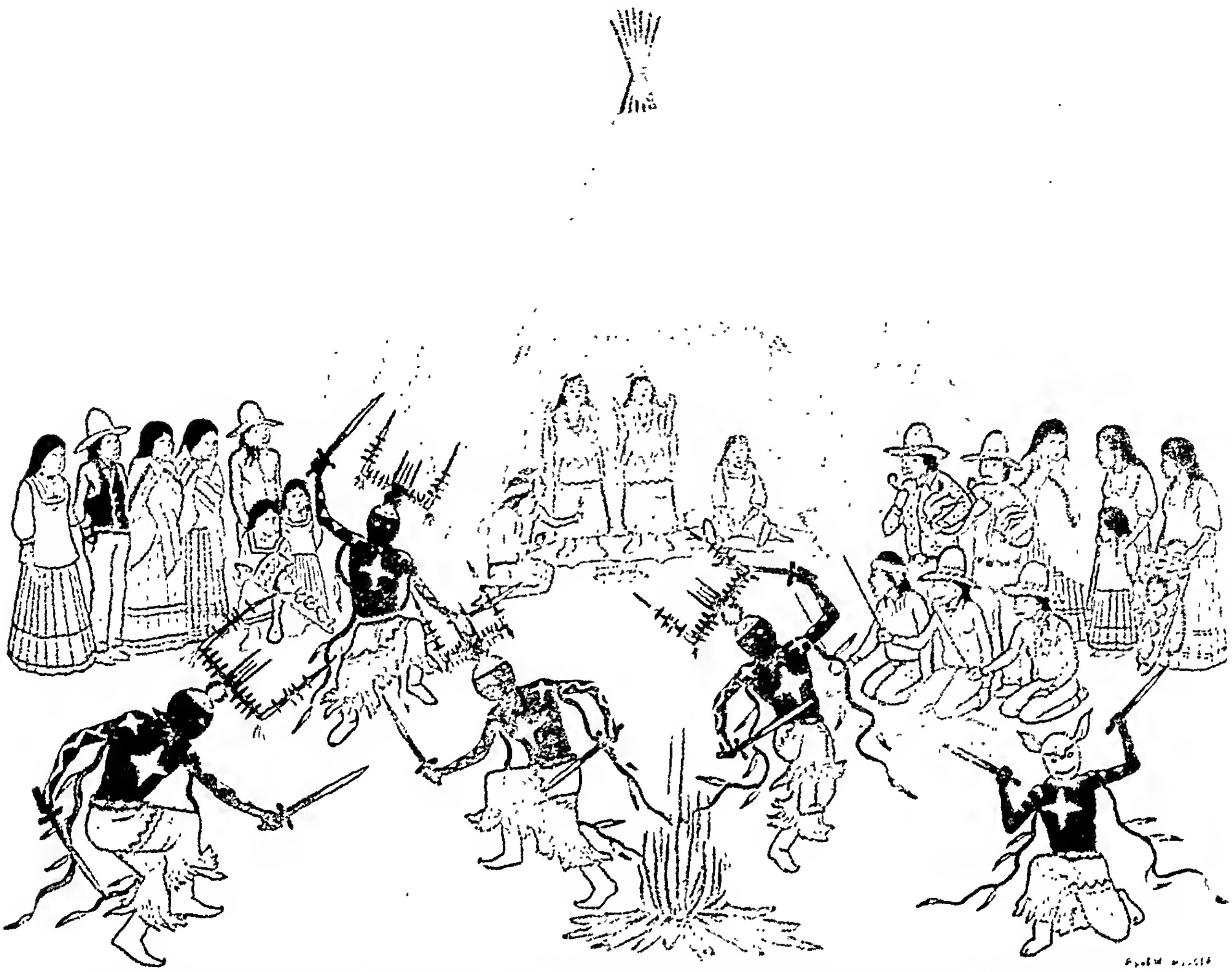
SAND PAINTING IN A NAVAJO MEDICINE LODGE

Here a Navajo medicine man makes a sand painting by sprinkling colored sand in a traditional design. It includes figures of Navajo gods, stalks of corn, and other sacred symbols. Sand paintings were made for treating the sick with ceremonials such as the night chant (Yebitchai). They were made in a single day and destroyed before sundown.

In many tribes, this guardian spirit became the Indian's sacred totem animal. A Plains Indian might paint its picture on his tepee. The wood carvers of British Columbia and Alaska placed the sacred animals on totem poles, house fronts, and in other carvings.

Villages and tribes sought spirit help with dances and other ceremonials. In general the men of the tribe conducted these activities. Usually they had a house where secret societies met, sacred objects were kept, and ceremonials were taught to the young.

CEREMONY WHEN APACHE GIRLS "CAME OF AGE"



The Apache painter and sculptor, Allan Houser, painted this picture of one step in the four-day ceremonial which admits Apache girls to womanhood. The young initiates and their godmother are within the sacred evergreen bower. Outside are the drummers, and the medicine men who sing the religious chants. In the foreground the famous Apache "crown" or "devil" dancers and the clown perform. The women's tribal dress is patterned after that of early white settlers.

Important ceremonials lasted for many days and were preceded by periods of fasting and prayer. As a rule, the aid sought was rain for the crops, game for the hunters, or success in war. The most spectacular Plains ceremonial was the Sun Dance. This included self-inflicted tortures by some of the warriors.

Corn dances were held by all farming tribes and are still a feature of Pueblo Indian life. One of the most elaborate corn festivals was the *busk* held by the Creeks. After feasting on the new corn, dancing, drinking the "black drink," and carrying on ceremonies for several days, the tribe began a new year by destroying their old clothing, pots, and other equipment, and taking new ones. They extinguished all fires and lit new ones from a ceremonial flame. Old enmities were forgotten and evildoers were forgiven.

Healing and Medicine Men

The Indians believed that diseases were caused by evil spirits, or good spirits who had been angered. Therefore they used charms and magical ceremonies in an effort to remove the evil influence. The magical procedures were usually performed by specialists who were supposed to have unusual power to control spirit forces. Indians called them by such names as "mystery man," "singer," or "the wonderful." White people called them medicine men. The magic workers also served somewhat as priests in leading ceremonials and in preserving sacred objects.

The charms and ceremonies varied from tribe to tribe. The Navajos made paintings with colored sand, following time-honored designs. The Iroquois False Face Society practised "preventive medicine." The members wore masks carved from a living tree to represent faces seen in dreams. In spring and fall, when illness was common, the masked medicine men went from house to house, shaking turtle-shell rattles and chanting to drive away the demons of disease.

Some treatments included use of herbs and roots as medicines. Both men and women, other than magic workers, could prepare these medicines, bandage wounds, and nurse the sick.

Social Organization and Customs

Since most Indians lived in small communities, they based their government and social organization upon

FORMATION OF THE IROQUOIS CONFEDERACY

This diorama from the Milwaukee Public Museum pictures the council at Onondaga that organized the Iroquois league about 1570. Hiawatha, the great Mohawk leader, is making a stirring plea for peace and unity. Around him sit chiefs of the Seneca, Onondaga, Oneida, Cayuga, and Mohawk tribes. The wampum belts on the rack at the left were symbols of the authority of representatives to act for their tribes. Belts and strings of wampum made from shell beads were also used as records of events and as currency.

loyalty to the family and the tribe. In most tribes families were linked in a third group, called a clan or gens. In a clan, inheritance and relationship traced through the female line; in a gens, through the male line. Families in a clan frequently lived together in community houses. Here children looked upon their cousins as brothers and sisters and regarded their aunts and uncles as parents. Men and women were required to marry outside their own clan.

Women and Children in the Tribe

Women exercised great influence on Indian life. This was especially true in such tribes as the Iroquois, where descent was through the mother. Marriage customs differed from tribe to tribe. As a rule they were the result of mutual agreement by husband and wife. Often the bridegroom made some sort of present to the bride's family to compensate the girl's family for the loss of her help.

Divorce was usually easy if a couple could not agree. But the children did not suffer from the breakup of the home. They continued to live in the clan group and could look to uncles and aunts for attention.

Indians were universally kind to children. Discipline was strict, but it was never enforced by whipping or other physical punishment. Children were expected to help with the family duties. The first time a boy brought home an animal shot with his own bow, his proud father might celebrate with a feast. Ceremonials marked the date when youngsters reached 13 or 14 years of age and were considered men and women.

How Indians Buried the Dead

Methods of disposing of the dead varied among the tribes. Burial in the ground was most commonly practised. Mounds were constructed for burial among certain prehistoric Indian peoples (*see* Mound Builders). In the Southwest bodies were sometimes placed in caves where they dried, or mummified, in the dry air. On the northern plains a common practise was to place the dead in trees or on scaffolds. On the northwest coast they might be laid in canoes set high on posts.

Cremation was practised by various tribes from the Pacific coast to Florida. Usually the ashes were buried in pottery vessels. Almost invariably domestic utensils, food, and the ornaments, implements, and other personal belongings of the departed were placed with the remains.

Leadership and Government

Government was generally extremely simple and democratic among the Indian tribes. The chief was not an autocratic ruler. He was usually chosen because of his ability and wisdom, though in a few tribes the office was hereditary. He advised the people and attempted to settle their disputes. A war chief was selected to lead a raid or campaign. Tribal and village councils discussed and acted upon important matters. A council might consist simply of the adult men of a village or it might be composed of chiefs of clans. Among the Iroquois, matrons took part in grand councils.

The Iroquois Confederacy was the highest form of political organization among the North American Indians. About 1570, the Mohawk, Seneca, Onondaga, Oneida, and Cayuga tribes (all the Iroquoian language family) created this confederacy to promote peace among themselves. White people called this league the "Five Nations," and later the "Six Nations," after the Tuscaroras were admitted about 1722. The Iroquois called it the "Brethren of the Long House."

The founders set up the framework of a code of laws which, though unwritten, had the force of a formal constitution. The Great Council Fire of the league, held at Onondaga, was its governing body. Representatives of the tribes met here to formulate policies and to take action.

Indians of Other Times and Places

THE INDIANS of the five leading culture groups are of chief interest to the people of the United States and Canada. They helped make the history of the two nations. They are part of American literature and folklore. Their achievements in making clothing, shelter, tools, utensils, and the like seem the more significant because they used materials from familiar stones, trees, and animals.

But the Indians north of the Rio Grande probably made up less than one-tenth of the Indian population of the Americas when the continents were discovered. Middle America (Mexico and Central America) had at least four times as many people as the northern part of the continent. South America's Indian population was greater than that of Middle and North America.

Indians of Middle and South America had advanced farther in many ways than those of the north. Plant growers of these regions had domesticated most of the plants the Americas have given the world. After obtaining a dependable food supply from agriculture, able peoples living along the highland belt from Mexico to Chile made enormous strides toward civilization. The leaders were the Incas and other Andean peoples of Peru, the Mayas of Guatemala and Yucatán, and the Toltecs and Aztecs of Mexico.

The Indian has also remained much stronger in influence and numbers in Latin America. It is estimated that 20 million pure-blooded Indians and 78 million persons of mixed Indian and white blood live in the Latin Republics (*see* Latin America). Compare this huge population with the 343,410 Indians in the United States at the 1950 census and the 144,787 (including 9,733 Eskimos) in Canada in 1951.

Peopling the Americas

It is difficult to imagine how tribes of wandering hunters could have migrated from Asia and eventually peopled the entire hemisphere. Of course, no single person made any large part of the long journey from Alaska down the continents. But one group after another continued the march—traveling in small bands so they would not kill or frighten away all the game.

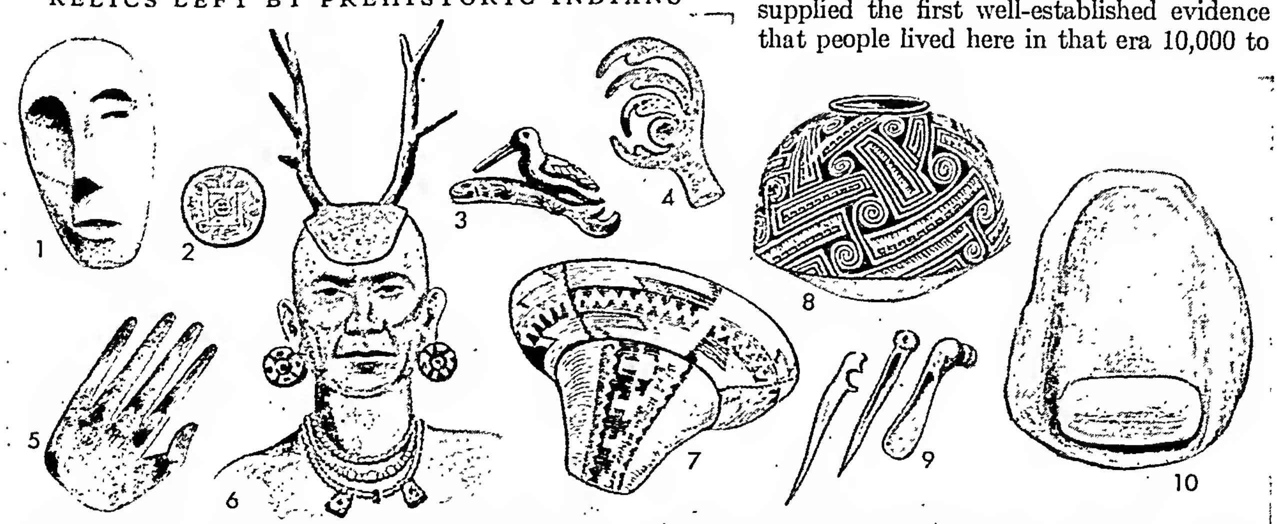
Archeologists have dug into their ancient camping places. They have found the ashes of their fires, the bones and shellfish shells they threw away after dinner, and their primitive tools and weapons. The findings indicate that the first American Indians lived by hunting, with some fishing and gathering of seeds and other wild foods. They had lances or spears tipped with stone points. Probably they hurled them with a throwing stick, called an *atlatl*. The bow and arrow were likely invented or brought to America later. They knew how to make stone tools, such as knives and scrapers, hammerstones and axes. They had methods of lighting fires, and a single domestic animal, the dog. But they had no knowledge of agriculture, pottery, or metals.

Work of the Archeologist

Modern students must get their information about early folk from the archeologist, because they left no written record. The archeologist gets help from other scientists in estimating the period when a camp or village was occupied. The geologist studies the soil layer and uses such evidence as ancient, dried-up lakes, cave debris, and glacial deposits to tell when the stratum was laid down. The paleontologist and the paleobotanist study the animal and plant remains. If timber is present, the scientists may be able to find out when it grew by comparing its growth rings with a "tree-ring calendar" going back to the birth of Christ (*see* Drought).

Remains of early man have been found in both Americas in layers of earth deposited during the Pleistocene epoch, when vast glaciers spread over northern lands and mountaintops (*see* Ice Age; Geology). Discoveries near Folsom, N. M., in 1926–27, supplied the first well-established evidence that people lived here in that era 10,000 to

RELICS LEFT BY PREHISTORIC INDIANS



Indian craftsmen of long ago made these objects: 1. A stone mask found in Kentucky. 2. A shell breast ornament from Tennessee. 3. A Hopewell carved stone pipe, representing a duck seated on a fish, from Ohio. 4 and 5. A bird claw and a hand cut from mica by Hopewell artists. 6. Model of a Hopewell man wearing a copper headdress, a pearl necklace, and copper ear plugs. 7. An Anasazi burden basket made about A.D. 500. 8. A Hohokam jar of about A.D. 1000. 9 and 10. Anasazi bone scrapers and metate and mano.

13,000 years ago. Projectile points (probably spear points) were found near the rib bones of an extinct variety of bison. These points had a central groove not found in those used by Indians of historic times. Later similar points were found as far east as Massachusetts and south to Texas. Most of them were discovered on the Great Plains along the eastern slope of the Rockies—the ice-free corridor followed by early migrants from Bering Strait (*see* Folsom Man).

Later excavations uncovered many sites where early man's projectile points, tools, and beads were found with bones of the extinct camel, bison, mastodon, mammoth, ground sloth, or American horse. In a cave in the Sandia mountains of northern New Mexico, archeologists found even older artifacts (man-made objects) in a layer beneath Folsom remains. They included a spear point with a notch, or shoulder, on only one side.

The following list of significant finds, with estimated time of occupation, is from 'Indians before Columbus', by Paul S. Martin, George I. Quimby, and Donald Collier of the Chicago Natural History Museum:

Folsom culture (Colorado and New Mexico), from 10,000 to 13,000 years old; the Sandia culture (New Mexico), probably 15,000 years old; the Gypsum Cave culture (Nevada), probably from 5,000 to 8,000 years old; the Cochise culture (Arizona), which lasted from 15,000 to 2,500 years ago; the lowest layer in Ventana Cave (Arizona), 12,000 years old; the Lake Mohave culture (California), from 3,000 to 10,000 years old; the Pinto Basin culture (California), from 2,000 to 9,000 years old; and the George Lake Industry (Ontario, Canada), perhaps 10,000 years old.

Notice that the Cochise culture extended over an immense span of time. Differences in the artifacts in succeeding periods of this culture reflect the groping progress made by these Indians. Their grinding stones, or metates, indicate that the people depended on seed gathering for much of their food.

Fossilized Skeletons of Early Man

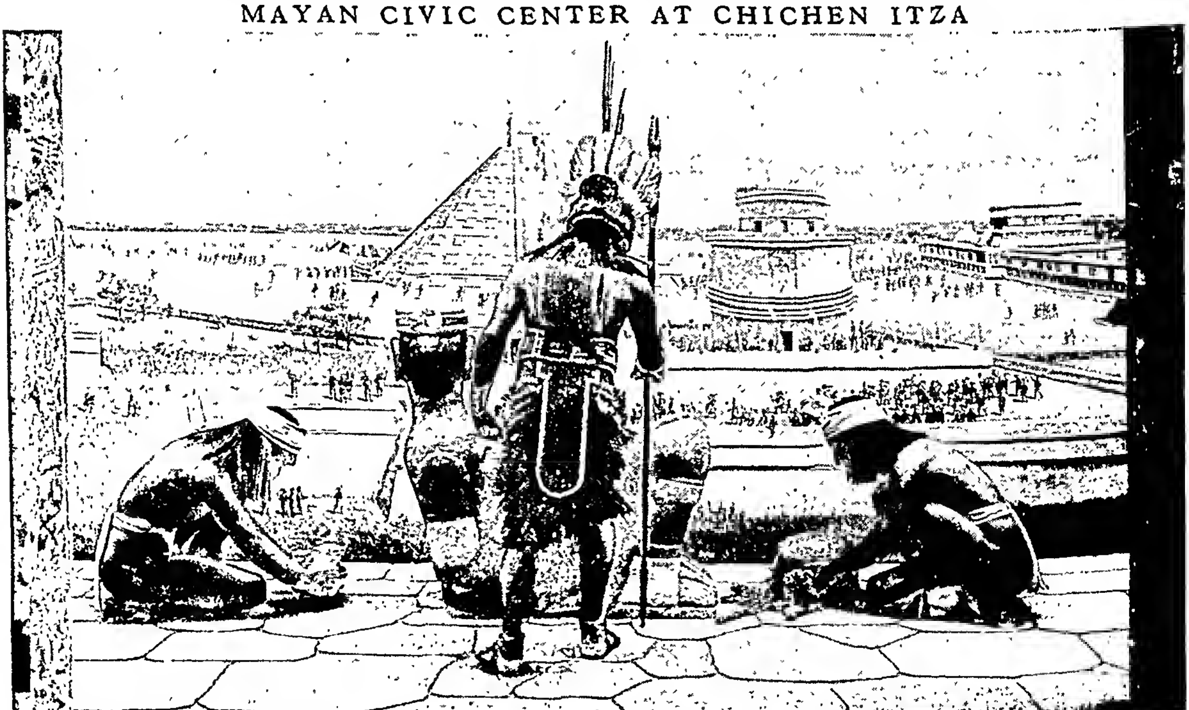
Numerous human skeletons have been found in ancient earth strata. But scientists are slow to accept the antiquity of skeletal remains, since people are often buried in layers of ground laid down eons before their birth.

A skeleton found near Pelican Rapids, Minn., in 1931, in deposits attributed to Pleistocene times, has been called "Minnesota Man." The bones are those of a 15-year-old girl, who is believed to have drowned in a glacial lake, perhaps as long ago as 20,000 years. The skull was relatively long and narrow for its width and showed Mongoloid characteristics. The jaws protruded and contained large, primitive teeth.

Another significant find was made near the village of Tepexpan, in the valley of Mexico, in 1947. The skeleton of a man was located by means of electrical prospecting apparatus in ancient lake flats that contained fossil elephant remains. A date of from 11,000 to 12,000 years ago has been ascribed to it. The skull was moderately roundheaded.

In South America, fossilized skulls were found in strata with bones of Pleistocene animals in Ecuador

MAYAN CIVIC CENTER AT CHICHEN ITZA



The spectator seems to stand in the doorway of a Mayan temple in this diorama at Milwaukee Public Museum. A priest is officiating at a ceremony. He is richly costumed, and the feathers of the sacred quetzal bird crown his headdress. Two men are making offerings before the stone image of a god. One offers an ocelot skin and a turquoise mosaic plaque, the other has a bowl of rare copal. Directly ahead stands the huge temple called El Castillo. The round building at its right was used as an astronomical observatory. At the far right rises the Temple of the Warriors with its "colonnade of a thousand columns."

and in the highlands of Brazil. They were longheaded. Other characteristics of what has been called the Lagoa Santa type skull include a slightly projecting face, a low forehead, and prominent cheekbones. Caves in Patagonia yielded five distinct layers of artifacts, through which scientists traced changes from the era of the extinct ground sloth to historic times. Arrowheads were not found until the fourth layer, but the third yielded small *bolas*. These are balls connected by a thong which hunters throw to entangle the legs of their prey.

Learning to Raise Plants and Make Pottery

Archeologists digging in the many village ruins spotted over the Southwest have traced three cultures as their peoples learned to raise crops, to weave baskets and cloth, to make pottery, and to build houses. They are called the Anasazi, the Hohokam, and the Mogollan-Mimbres cultures.

Archeologists found that these peoples had begun raising corn early in the Christian Era. They were able to give dates to many sites by means of tree rings and changing pottery styles. They worked out dates for the tree rings in the house beams of Anasazi villages. Thus they knew when Anasazi people made certain types of pottery. When they found a known type of Anasazi pottery in a Hohokam or Mogollan village, they could assume that the village existed about the same time and traded with the Anasazi potters.

Archeologists follow the Anasazi culture from the Basket Maker settlements of A.D. 100, through Great Pueblo times when the huge cliff dwellings were built, to the pueblos of today. The articles on Basket Makers and Cliff Dwellers and the Southwest Farmers section of this article describe their achievements and ways of life. These Indians lived in the plateau region where Colorado, New Mexico, Arizona, and Utah meet.

The desert people of the Hohokam culture lived in the drainage basin of the Salt and Gila rivers of southern Arizona. Their culture has been traced from A.D. 500 to 1400. Many archeologists believe they were descended from a western branch of the Cochise people and that the Pimas and Papagos are their modern descendants. They lived in pit houses, made buff pottery decorated in red designs, and wore woven sandals, and, later, cloth garments. They played a ball game on huge courts like those of the Mayas and were famous for their irrigation canal systems. An Anasazi people called the Salado moved into the Hohokam area about 1300. Their large pueblo houses are found in late Hohokam villages.

The Mogollan-Mimbres culture extends from A.D. 400 to 1450. These people may have been an eastern branch of the Cochise. Their villages were in mountainous country of southeastern Arizona and southwestern New Mexico. They lived in pit houses and buried their dead under the floors of the room, with grave offerings. They smoked pipes of stone or pottery and used stone tools and weapons. In the last, or Mimbres, period of the culture, under Anasazi influence they built pueblo-type houses and made fine pottery showing exquisite brushwork in the design.

A FALLEN SUN GOD

This elaborate piece of sculpture comes from the Huaxtec civilization of northern Vera Cruz. It reflects the influence of the Mayas to whom these people are related.

Mound Builders and Other Ancient Eastern Folk

The roving hunters east of the Mississippi did not begin settling in villages and raising corn, beans, and squash until A.D. 500 to 900. In their new sedentary life many tribes began making pottery and burying the dead in mounds. Other mounds were used for temple platforms and other sacred purposes. Some great earthworks took the form of animals and birds (*see* Mound Builders).

Ornaments, tools, and other artifacts found in villages of mound-building Indians have frequently been better than those made by the eastern tribes met later by white settlers. The Hopewell culture of southern Ohio was one of the most advanced. Here expert artists and craftsmen made carved stone tobacco pipes, a variety of pottery, flint and obsidian spear points, and sharp knives, axes, adzes, and other tools of obsidian and native copper. The women wove cloth skirts for themselves and breechcloths for the men. Headplates and breastplates were pounded from copper and meteoric iron. Artistic ornaments were cut from mica and necklaces were of pearl, bone, animal teeth, and metal. Hopewell traders scoured all eastern North America for materials. Settlements in Illinois and Wisconsin with a Hopewell culture may have been joined with the Ohio group in a confederation.

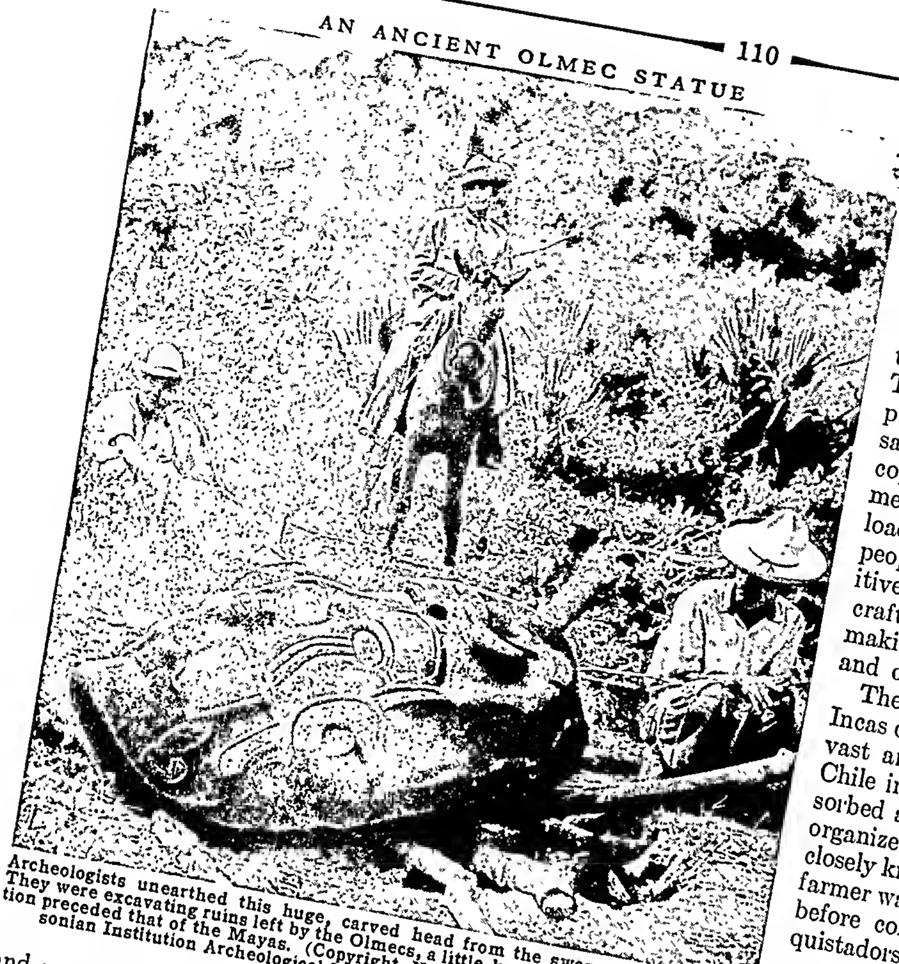
Tribes of the Lower Mississippi Valley reached their highest achievement after 1300. White settlers arriving about 1700 found their huge flat-topped pyramid mounds supporting temples where elaborate religious rituals were performed. The Indians had a government or social organization that could enlist the toil of many workers, for the mounds were built by heaping up basketful after basketful of earth.

Cultures of South America

The picture map at the beginning of this article reveals that in South America, as in North America, the Indians worked out three general ways of life, one depending upon hunting principally; one on farming, hunting, and fishing combined; and another on intensive farming.

The hunters of the southern plains used bolas, clubs, and bows and arrows in pursuing the guanaco and ostrich, while the women gathered starchy roots

AN ANCIENT OLMEC STATUE



Archeologists unearthed this huge, carved head from the swamps of Vera Cruz. They were excavating ruins left by the Olmecs, a little-known people whose civilization preceded that of the Mayas. (Copyright, National Geographic Society—Smithsonian Institution Archeological Expedition to Southern Mexico 1939–40.)

and grass seed. They depended upon the guanaco as the Plains Indians depended upon the buffalo, using its skin to cover their huts and to make containers and capes, moccasins, and other clothing. Their hunting improved after the Spanish brought in horses.

Indians of the southwest coast have been called Canoe Indians. Their big seagoing canoes were made of beech bark. They fished and hunted seals and sea otters and gathered shellfish and wild plants.

In the forested, northern tropical lowlands the men hunted, fished, and made war, while the women tended fields cleared by slashing and burning the thick growth. Bread from the cassava (manioc) they raised was the principal food, though the work of squeezing poison from the root and making flour was tedious (see Tapioca). Blowguns with poisoned darts, longbows and arrows, and clubs were the principal weapons used in killing the deer, tapirs, peccaries, monkeys, birds, and rodents of the area. Houses were made of log frames covered with thatch; and boats were built for river travel. Indians of this region learned to weave and to make useful and ceremonial pottery.

The Inca Civilization of South America

The advanced civilizations developed where intensive agriculture provided an ample food supply. The fertile soils of the Central Andes proved hospitable to man's newly domesticated plants and to his progress toward civilization. Evidence of crop raising there goes back to 1000–500 B.C. Corn probably appeared about 500 B.C.

Flourishing villages sprang up in coastal valleys where water was available for irrigation, and population centers spread to the high Andean plain. The farmers raised corn, beans, squash, potatoes, quinoa, sweet potatoes, cassava, peanuts, cotton, peppers, tobacco, coca, and other plants. They domesticated llamas and alpacas to carry loads and supply wool. The Andean peoples progressed far beyond primitive standards in engineering and craftsmanship, especially pottery making, fine weaving, metal smelting and casting, and stone construction.

The strongest of the tribes—the Incas of the highlands—conquered the vast area from northern Ecuador to Chile in the 15th century. They absorbed and improved the culture and organized an empire government so closely knit that the life of the smallest farmer was regulated. But they too fell before conquerors—the Spanish conquistadors led by Pizarro (see Incas).

Mayan and Aztec Architecture

Mayas of tropical Central America created two great centers. Their first cities rose in Guatemala and Honduras. Here stood stone temples and huge monuments, or stelae, carved with the faces of gods and sacred animals. On the stelae the date was inscribed in their numbering system. The priests were learned astronomers and devised a calendar more accurate than that used by Europeans. They wrote religious and scientific books in hieroglyphic writing. This period, the Old Empire, lasted from about A.D. 320 into the 10th century. Then the Mayas moved to Yucatán and built new cities. During their second period, the New Empire, the nobles and priests spent their lives in ceremonies and war while the farmers lived in thatched huts and raised corn and cotton. Weakened by civil war, most of the Mayas were conquered by the Spanish in 1527–46. (See also Mayas).

Prehistoric Mexico saw several Indian nations rise to eminence. Among them were the Toltecs, Zapotecs, and finally the ruthless Aztecs (see Mexico). The Aztecs article tells of their conquests, their arts and crafts, their fabulous city, Tenochtitlan, and their cruel religion, with its human sacrifice.

Scholars marvel at the achievements of the Indian civilizations. They wonder that they could build their mammoth structures without strong draft animals or sharp metal tools. The Indians had no wheel to help them in carrying, lifting, or making pottery. Only the Mayas had writing to pass on their knowledge.

Centuries of Struggle between Indians and Whites

WHEN the white peoples of Europe started to explore parts of the world unknown to them, they already had behind them a tradition of many thousand years of wars and conquests. Usually the stronger peoples had taken over the lands and property of weaker peoples.

When America was discovered the people of western Europe naturally thought of colonizing the continents. The fact that people were living there made no difference. They could be conquered and enslaved or just pushed aside. In Central and South America, the Spaniards conquered and enslaved. They sent to America only enough troops, priests, and administrators to control the country and exploit it.

The English settlers and others who came from northern Europe were equally determined to possess and settle the new land in North America. But they recognized that the native inhabitants had some title to the land. Therefore they were willing to buy their land.

Contrasting Indian and White Viewpoints

Two basic differences in white and Indian thinking, however, laid the foundations for conflict between them. The Europeans came from a culture in which individual ownership of land was universal. Indians, on the other hand, had no such custom. Land areas were held under the control of a tribe and the members were allotted portions of the area for cultivation or hunting. No individual Indian owned land.

The whites came from a civilization where government was highly organized and one man was authorized by heredity or election to speak for many. Among Indians such centralization of authority was exceptional. Indian leaders were democratically chosen. They could be recalled when their decisions ran counter to the wishes of the tribe. No tribal leader or council possessed the authority to dispose of tribal lands. When the whites insisted on acquiring permanent title to land, therefore, they bought something which by Indian custom could not be sold and they bought it from leaders who had no authority to sell it.

Causes of Conflict

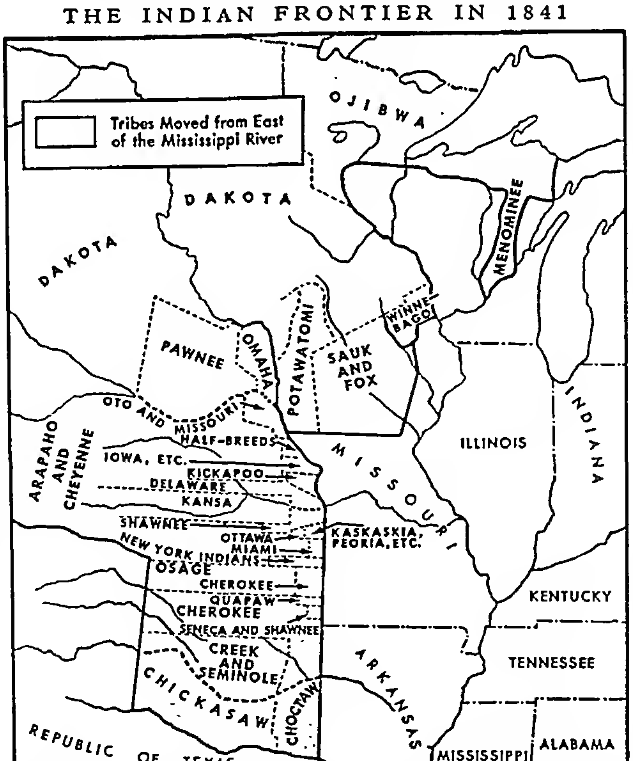
The Indians met the first English colonists with curiosity and friendship. They helped them to establish settlements and showed them how to cultivate native foods. In the first years of settlement, the Indian tribes could have united and exterminated the weak white colonies. But they had no tradition of military coöperation between tribes. Within a few years, however, the whites with their firearms, unity, and numbers were assured of ultimate victory.

In a sense, both sides had "rights." The Indians had the land first and they needed it for their livelihood. White settlers who cleared the forest and built homes felt that they had earned the land by toil and sacrifice.

Wrongs were committed on both sides. To the Indians whose lands were invaded, or whose villages and camps were attacked and men, women, and children killed or sold into slavery, the whites were bloodthirsty invaders. To the white pioneer who found his wife scalped, his children stolen, and his cabin and crops burned, the "only good Indian was a dead Indian."

Indians had bitter experiences with whites. While a few people tried to teach the Indians new ways to earn a livelihood, and missionaries sought to instruct them in Christianity, many people tricked and swindled them. Traders often made them drunk, the better to cheat them. New European diseases, to which they had no immunity, wiped out whole tribes. Among these diseases were smallpox, measles, tuberculosis, chicken pox, and scarlet fever.

THE INDIAN FRONTIER IN 1841



This map shows areas assigned to the tribes after the Five Civilized Tribes and others were removed to Indian Territory when Andrew Jackson was president. Few were left in the East. Most Great Lakes Indians had been pushed westward where they encroached on the hunting grounds of the Plains tribes.

The Indian practise of scalping contributed to their reputation for cruelty. No one knows surely when or how the custom grew up. It was not usual among Atlantic or Pacific seaboard tribes and appeared late among the Plains tribes. It was practised by many white frontiersmen and was encouraged by the powers contending for America. The English, Spanish, Dutch, and French paid their Indian allies for scalps.

Wars with the Colonists

One of the earliest quarrels broke out in 1637 between the Connecticut colonists and a group of Pequots. A white trader who had mistreated the Indians was murdered. Colonists attacked a Pequot village near Mystic and killed about 600 Indians.

In New England, Metacom, or King Philip, son of the friendly chief Mas-

sasoit, formed an alliance to resist the whites. Between 1657 and 1676, Indians attacked more than 50 white settlements, destroying a dozen. They were finally beaten in Rhode Island (*see* King Philip's War).

During the 17th century there was similar fighting between whites and Indians in Virginia, and the Dutch around New York warred against the Wappinger tribes. In the French and English wars, from 1689 to 1763, the Iroquois aided the English, and the Algonquins helped the French (*see* French and Indian War).

Pontiac, an Ottawa chief and ally of the French, organized many tribes in Ohio and Illinois to attack the British outposts in 1763. The Indians successfully wiped out many of the smaller forts. They laid siege to Detroit and Fort Pitt (now Pittsburgh). Pontiac then learned that the French and British had made peace. He raised the sieges and concluded a treaty with the English in 1765.

Many of the tribes fought for Britain in the Revolutionary War. Later, Tecumseh, a Shawnee leader who was friendly with the Creeks, organized many southern and western tribes to oppose further cession of Indian land to the whites. They were defeated at the battle of Tippecanoe (*see* Tecumseh).

"The Trail of Tears" to Indian Territory

In the South, the powerful Creek Confederacy sided with the British in the War of 1812. They were defeated by Gen. Andrew Jackson at Horseshoe Bend in 1814. This conflict may have contributed to Jackson's determination, when he became president, to remove the Five Civilized Tribes (Cherokees, Creeks, Choctaws, Chickasaws, and Seminoles) to a new Indian territory west of the Mississippi. After another defeat by Gen. Winfield Scott in 1836, they were moved west, much against their will and in the face of a Supreme Court opinion in their favor. The Cherokees called the long, bitter march "the trail of tears."

In 1832 Black Hawk, a subordinate chief of the Sauk and Fox Indians, refused to accept the terms of a treaty negotiated by the tribal leader, Keokuk. Under it, the Indians abandoned their lands east of the Mississippi. After a series of bloody border raids, his band was effectively defeated on Aug. 3, 1832, at the mouth of the Bad Axe River.

In the 18th century a group of Creeks withdrew into Florida, then owned by Spain. They became known as Seminoles, the Creek word for "runaways." They fought the Americans during the War of 1812 and again in the First Seminole War of 1817. The Americans, under Jackson, invaded Florida. Spain shortly ceded it to the United States. The Seminole leader, Osceola, resisted removal to Oklahoma after other leaders had agreed (*see* Osceola). After defeat in the Second Seminole War, many of the Indians were removed. About 500 remained in the Everglades.

Conflict in the Southwest

The westward-moving white settlers outstripped government officials who were supposed to maintain friendly relations with the Indians, and so the conflicts were transferred to the West. The American settlers generally respected the rights of the sedentary and peaceful Pueblos, Pimas, and Papagos to their homes and fields. The rights of the Apaches and Navajos were not so obvious, since they planted a garden and then went hunting while it matured. White settlers, who took many of their traditional garden spots, saw nothing to do but shoot the Indian owners when they returned to protest. Apache retaliation took the form of burned ranch houses and dead ranch families.

Even after the Indians accepted restriction to reservations, white attacks and Indian raids continued. The most notorious raids were led by the Apache, Geronimo. He terrorized the Southwest for several years, before he surrendered in 1886. He and his band were exiled to Oklahoma.

Defending the Plains Hunting Grounds

Before they ever met white settlers, the Plains Indians experienced the conflicts which grew out of the movement of peoples. The Ojibwa were pushed westward from Ontario and Wisconsin by the invading French. They forced many Sioux out of Minnesota and onto the Great Plains. The Sioux, in turn, pushed others of the Plains tribes still farther westward.

When wagon trains started crossing the plains to the Far West, they met little resistance from the Indians at first. Whites did not want to settle in the country, for it was considered a desert. But the Sioux who remained in southern Minnesota had desirable land and the whites ousted them. The Indians fought back, and armed opposition to the frontiersmen spread westward. The Plains tribes began to attack wagon trains in Nebraska and Wyoming.

Efforts by the army and the government to preserve peace led to the 1851 Treaty of Laramie. The Sioux promised to remain within the Dakota area, and the government, in turn, agreed to keep settlers out. This agreement was violated by the government in 1865 when it began constructing forts and wagon roads to the Montana gold fields.

The Plains tribes under Red Cloud opposed the treaty violations. After destroying a series of forts, they negotiated another treaty with the government at Fort Laramie, Nov. 6, 1868. For the only time in the history of white and Indian conflicts, the government capitulated completely. It stopped the construction of the Montana road, dismantled the forts, and again guaranteed the Indian reserve.

In 1871 the government broke this treaty by permitting surveyors for the transcontinental railroads to enter the Great Reserve. In 1874 Col. George A. Custer led a reconnaissance group into the Black Hills and gave out reports of rich farm lands and gold deposits to be found there. This started a stampede of gold seekers. An attempt by the government in 1875 to buy the Black Hills failed.

While the Indians agreed to stay in the Dakota area, they were permitted to send hunting parties into Wyoming and Montana. During the Black Hills negotiations the army ordered these parties to return to the reservations in the midwinter of 1876.

Colonel Custer was sent to enforce the order. He divided his force into three groups and advanced into

SMOKING THE CALUMET, OR CEREMONIAL PIPE

These Plains Indians pass the calumet, or ceremonial pipe, as a gesture of friendship. Since the calumet was used in peace ceremonies and treaty making, it is often called a peace pipe. Tobacco originated in America. The Indians regarded it as sacred "medicine." Even in tribes which grew no other crops, the men cultivated it for ceremonial use, or they plucked wild tobacco leaves.

the valley of the Little Bighorn. The center group under his own command surprised the main body of Indians under the Sioux chiefs Sitting Bull and Crazy Horse. Custer's troops were wiped out on June 25, 1876 (*see* Custer). It was the last major victory won by the Indians. Gradually the rebellious chiefs and their bands were defeated and settled on reservations.

In northern California, the Modocs rebelled at being removed to the Klamath reservations, where traditional enemies lived. In the battle of the Lava Beds, near Tule Lake, in 1873, 75 Indians stood off 400 white soldiers but were finally defeated.

Last Fight at Wounded Knee

About 1888, a Nevada Paiute Indian, Wovoka, had a vision and became an Indian Messiah. He predicted that the white man would be wiped out and the buffalo would return, if enough Indians would perform the Ghost Dance. Sitting Bull and other Standing Rock Sioux joined the new cult. Fearing an uprising, the Indian agent ordered Indian police to arrest the chief. A fight broke out and Sitting Bull was killed.

A party of his followers started to the Pine Ridge Agency in southern South Dakota to protest. They camped at Wounded Knee, east of the agency. Officials there feared that they were armed and sent a body of raw recruits to surround and guard the camp. Toward morning a recruit fired his gun and soon the troops had massacred nearly the entire party of men, women, and children. This was the last and, by Indians, the most bitterly resented of the conflicts.

The Indians and the Government

Great Britain and its colonies established the policy of restricting the purchase of Indian land to representatives of the government in order to protect the Indians from sharp trading by individuals. This policy was made into United States law by Congress in 1790.

Originally the government dealt with Indian tribes as it did with other nations. Agreements became treaties and had to be ratified by the Senate. Many of these treaties are still in force.

When the Indians sold land, they nearly always reserved a portion of it for their own use. Or they might accept other land in exchange for the land they sold. These reserved lands became the reservations where more than two-thirds of the Indians live today. (For locations of reservations, *see* state maps.) The Federal government guaranteed that these lands be reserved for the permanent use of the Indians.

Usually the Indians did not sell their land for money alone. They wanted the greater portion of the purchase price in the form of agricultural implements, seeds, stock, such services as schooling and medical attention, and in guarantees of tax exemptions on reservation lands. In some cases, the government promised the Indians that it would furnish them with food rations and clothing until they learned a new way of life if they would settle on reservations. It has been estimated that the United States has paid in cash and in kind about a billion dollars for the more than 2,500,000 square miles of land bought from the Indians.

Creation of the Bureau of Indian Affairs

It was necessary for the Federal government to have an agency to see that governmental promises under the treaties were carried out. The first such agency was placed under the secretary of war by a Congressional act on Aug. 7, 1789. In 1824 a Bureau of Indian Affairs was created within the War Department. An act of June 30, 1834, specified the duties of the department of Indian Affairs, and it remains the organic law for all administration of these affairs. With the creation of the Department of the Interior on March 3, 1849, the bureau was transferred to this civilian agency.

The bureau enforced the restrictions on Indian lands and prevented their illegal loss. It helped the Indian sell his land, when that was legal; and it kept track of land inheritance when the original owner of property died.

When the leasing of Indian lands became legal, the bureau was directed to supervise it. In the early days, a great deal of money was deposited in the United States Treasury to the credit of Indian tribes in payment for lands. The administration of this money on behalf of the Indians fell to the bureau.

The bureau carries on a variety of services for the Indians today. It operates schools and hospitals, does adult education work, handles irrigation projects, and administers many Indian enterprises. Everything the Bureau of Indian Affairs does, and the way in which it is done, is directed by Congress. And Congress must appropriate funds to pay for its work.

The General Allotment Act of 1887

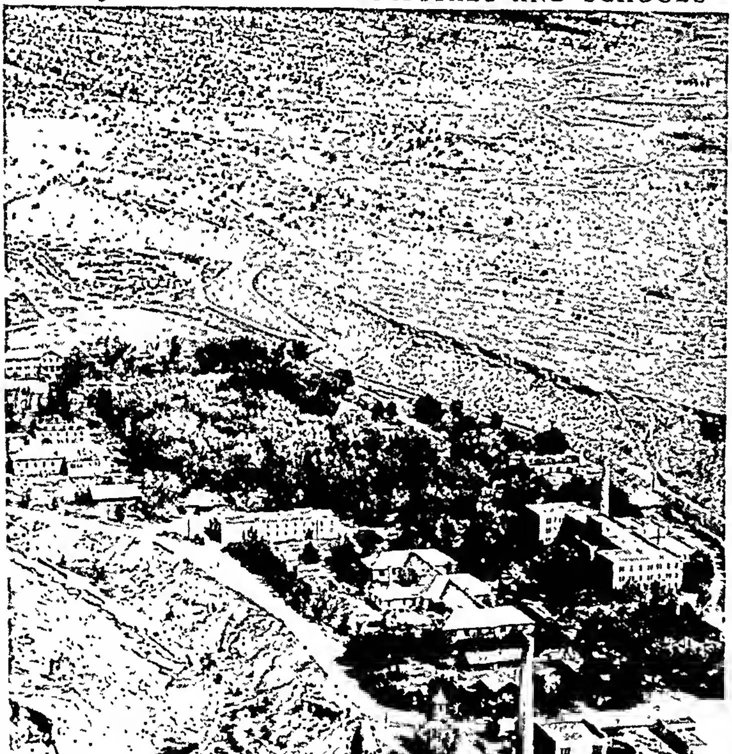
Federal Indian policies have changed from time to time, and often they have not benefited the Indians. By the 1880's most of the tribes were living on reserved lands The Indian population had dropped from an estimated 850,000 in 1492 to about 250,000. The decrease had been due to wars, to the white man's diseases, to liquor, and sometimes to starvation when the hunters' game disappeared as white settlers spread over the hunting grounds.

Many people felt that the Indian's adjustment to the white man's way of life was too slow, and they looked for a way to speed it up. They regarded individual ownership of land as the basis of American success and hoped that possession of farms would turn the Indians into farmers. At the same time, land-hungry white people thought that too much land had been reserved for the "vanishing race."

Both groups urged the passage of the General Allotment Act of 1887. This act provided for dividing the reservations, which had been held in common by the tribes, and for allotting a piece of land to each Indian. After land had been assigned to the living Indians, the "surplus" was opened to white homesteaders. None was reserved for future Indian children. An initial "trust period" was established, after which the Indian was free to sell his land.

This law resulted in the loss of 86 million acres of Indian land. Still unused to the idea of individual ownership or sale of land, and without knowledge of money values, many Indians sold their allotments at low prices, spent the money, and became destitute. Where land was retained, the pieces owned by each Indian became smaller as the land was divided through inheritance.

NAVAJO RESERVATION HOSPITALS AND SCHOOLS



Here are a general hospital, a tuberculosis sanatorium, and a boarding school built and operated by the Bureau of Indian affairs at Fort Defiance, Ariz. They serve the Navajos—largest of the United States tribes. Before 1935, an agency for one-fifth of the Navajo reservation was also maintained here. Other buildings include repair shops, a heating plant, and employee homes.

Indian Reorganization Act of 1934

The Indian Reorganization Act, passed by Congress on June 18, 1934, stopped the allotment of land and sale outside the tribe. It also provided for regaining some of the "surplus" lands and authorized the purchase of additional land. It directed the secretary of the interior to make regulations applying conservation principles to timber logging and rangeland grazing.

The act also provided a means by which Indian tribes may organize for self-government, much as an American town or city may incorporate under state laws. The tribes may also incorporate to carry on public business the way cities run water or power systems. The act authorized appropriation of funds for loans to these corporations and, through them, to individual Indians, for economic development.

Individual Indians may also borrow money under the act for advanced vocational and collegiate education. The act also provided for increased employment of Indians by the bureau.

The act was to apply only to those tribes which voted to accept it within two years. In that period, 181 tribes accepted it, 77 rejected it. and 14 came under it automatically by failing to vote against it. Of these, 95 adopted constitutions and by-laws; and 74 were granted charters to operate as business corporations. Later the provisions of the act

were extended to Oklahoma and Alaska, which had been omitted from the original act. Indians of these areas may vote at any time to take advantage of the act. Thirty Oklahoma tribes and 100 villages in Alaska have organized under the act and have adopted constitutions and charters.

Indian Claims

During Western settlement many misunderstandings and some unkept promises grew out of land transactions. The government permits the Indians to sue the United States in the Court of Claims to correct these injustices. However, it is first necessary to obtain an enabling act from Congress before suing.

Awards by the Court of Claims include 17 million dollars to 17 groups of California Indians whose land treaties had never been ratified by the senate; 16 million dollars to four small Oregon bands; and 31 million dollars to Ute Indians. In all cases, past federal expenditures on the group are subtracted from the award. For instance, the net recovery of the California Indians was reduced to about $5,025,000.

On Aug. 13, 1946, Congress created an Indian Claims Commission to clear up all pending claims. The commission was empowered to hear all outstanding Indian claims and render judgments. Congress then would appropriate the money to pay the judgments.

Indian Life in Modern America

THE largest number of the Indians in the United States today—some 250,000 of them—live on reservations. They have advantages on the reservation that they would not enjoy elsewhere. They live among their relatives and friends. They have the use of tax-free land in earning a living. This freedom from land tax was part of the price they asked when they sold the rest of their land to the government. The Federal government, through the Bureau of Indian Affairs, provides most of the services other citizens get by paying taxes to town, county or state.

A reservation differs little from the land around it. A motorist on a highway may know that he is passing a reservation only by seeing a sign giving the name of the reservation. In the northwestern reservations, the houses of Indian farmers or stock raisers look very much like those of their white neighbors.

The Indian agency, or local headquarters of the Indian service, rises amid the farming, grazing, or forest land. It resembles a small town, and sometimes a town has grown up around it. Here stands the office of the agency superintendent and his assistants. They direct the government program, keep records of land titles, and act as bankers for the money of individual Indians. Here too are offices of agricultural agents and home demonstration agents, forestry supervisors, field nurses, and other federal employees. Some offices may serve as quarters for the Indian tribal council, which carries on activities similar to those of county commissioners, and for the Indian police, who enforce council ordinances.

The school buildings include an elementary day school, sometimes a federal high school, and possibly a boarding school for orphans or other dependents. Near by will be found an Indian service hospital, a store or trading post, and one or more mission chapels.

In the agency town, the government must construct all the public buildings, provide a water supply, sewage system, and power plant. It also builds the reservation roads.

Small crossroads settlements, like those of any other farming or grazing area, are spotted over large reservations. They will have a day school, a trading post, and sometimes offices for a farm agent, a field nurse, and a field doctor. Where taxpaying white families live in the area, the school will be a public school. Otherwise it is a federal institution, and school busses collect its pupils from outlying farms or ranches.

MEETING OF A TRIBAL COUNCIL IN OKLAHOMA

These members of the Kiowa, Comanche, and Apache tribes are gathered in the auditorium of Riverside School, in Anadarko, Okla., to discuss problems of self-government. The mural on the rear wall shows the talents of one of the agency artists.

Differences in Reservations

In the Northern states, reservations were allotted many years ago and much of the former Indian land has been acquired by white people. Today they live side by side with the Indians. This is also true in Oklahoma, where reservations were abolished many years ago but where many Indians still own restricted (nontaxable) land. In the Southwest, only a few reservations were allotted and only a few white families live on reserved areas.

The Pueblo Indians live in villages and go out to farm surrounding lands, as their people have always done. A trading post, a school, and a church usually stand near, but not within, the pueblo.

Navajos, Apaches, Pimas, and Papagos live in homes scattered over the land. They build them near springs or streams. Most of the schools are federal day schools. A health center, or offices for a field nurse or farm agent, may be located near the school. Traders usually find locations near a water source. They may have no near neighbors.

The Trading Post

Reservation stores are called trading posts, because they first accepted Indian produce in exchange, or trade, for what they had to sell. The Indians had lambs, wool, cattle, hides, farm produce, or products of handicrafts, such as jewelry, rugs, and rawhide or beaded buckskin articles. They bartered these goods for coffee, flour, sugar, clothing, horse gear, fence wire, and kitchen equipment. The trader kept a record of the value of goods accepted and charged against this the produce sold to the Indians. Now much of the business is on a cash basis.

Traders also act as bankers for the Indians. They lend money, cash checks, receive and deliver mail, and render many other personal services. Traders are licensed by the Indian service. Regulation prevents exploitation such as was practised in early times.

Indian Government and Legal Rights

For many years after Indians began living on reservations, tribal self-government was largely supplanted by government control through the Indian service. Then the Indian Reorganization Act set up a pattern by which self-government has been restored in many places. Communities with charters now elect councils which control law and order through tribal courts, and handle land matters, coöperative business enterprises, and many other community affairs.

On reservations a Code of Indian Offenses may be substituted for the state statutes. It is based on tribal customs, which the Indians understand. Under this code only a limited number of crimes (such as murder or kidnaping) are referred to federal courts.

Indians born within the United States have had full citizenship rights since 1924. They are entirely free to come and go as they please. At the close of the Indian wars attempts were made to confine hostile Indians to reservations, but the courts declared these laws unconstitutional many years ago.

How Indians Make a Living

Most Indians depend entirely upon their own efforts for support. Perhaps the largest share of reservation Indians are farmers, stockmen, loggers, or millhands. Some live on the rents from their lands or on royalties on mineral rights. Many engage in seasonal labor off the reservation. They work on railroads, roads, farms, ranches, or in orchards.

Indians may also work at the handicrafts of earlier times. The rugs of the Navajos, the jewelry made by them and some of the Pueblos, the pottery and baskets of the Southwest, the buckskin- and beadwork of the Northwest, and the bark work of the Northeast are greatly admired today. The Indian Arts and Crafts Board encourages young Indians to learn the crafts and advises craftsmen in making salable objects and in marketing their wares.

Federal schools also teach and encourage painting and other native arts. A significant group of Indian painters and muralists have adapted Indian styles to their work. Paintings by several of these artists appear in this article.

Government Assistance

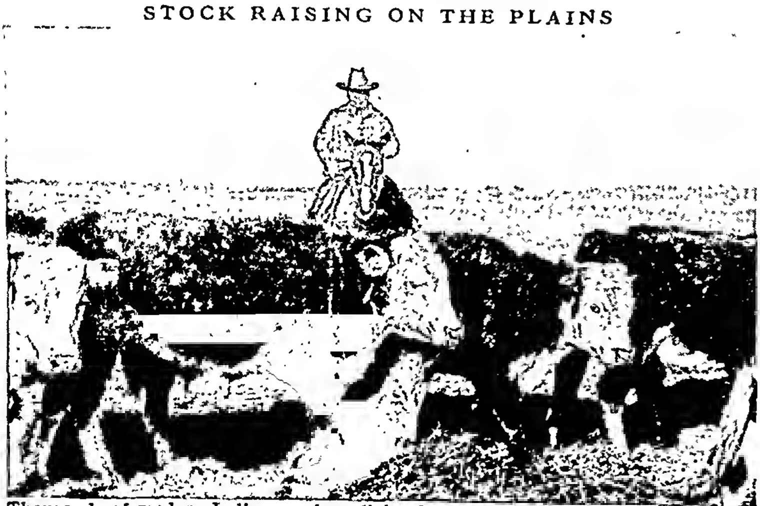
Indians generally have small incomes and maintain a low standard of living. Efforts of the Indian service to improve their opportunities include a plan to purchase additional reserve land for those who wish to farm, instruction in better use of the land, and vocational training for off-reservation jobs.

Direct relief is given by the government in needy cases. Only 4.3 per cent of Indian income, however, came from this source in 1949. In that year $1,550,000 out of the total bureau appropriation of $48,850,000 was paid directly to Indians. The remainder financed the services to Indians and the construction and maintenance of roads, buildings, irrigation works, and other facilities.

Tribal Resource Development

Various tribes carry on community projects to develop the resources of their reserved areas. These enterprises have increased since the Reorganization Act provided for charters to do business and for loans to finance them. The Menominee Reservation of Wisconsin holds a fine stand of timber which the tribe is logging and cutting into lumber. Many of the tribe work for wages in the woods or in the lumber mill, and all members receive

STOCK RAISING ON THE PLAINS



Thousands of modern Indians make a living by raising cattle or sheep. Here the chairman of a tribal cattle association is rounding up his stock on the Fort Hall Reservation in Idaho. High-grade reservation cattle bring good prices at sales.

GETTING A PRACTICAL EDUCATION IN THE INDIAN SCHOOLS

1. High-school boys in the Carson Indian School, Stewart, Nev., get practical training in dairying. 2. First-grade pupils at Sequoyah Indian Training School in Oklahoma care for chickens as their first lesson in homemaking on the farm. 3. Navajo pupils study English and letter writing at the Church Rock, N. M., day school. 4. A Karok boy at the Carson School, studying to be an automobile mechanic, overhauls the brakes on an old car. All these schools are operated by the Branch of Education of the Bureau of Indian Affairs.

a share in the annual profits. The Menominees finance their own school and hospital and pay the salaries of federal officials who handle their affairs. Since the timber is being cut on a sustained yield basis, it will last for many years. The Klamath Indians of Oregon have a valuable forest which is being lumbered under approved contracts.

At Fort Apache in Arizona a forest is being logged and a large cattle herd is also being pastured on the forest and meadowlands. The Jicarilla Apaches, in northern New Mexico, make a living from sheep grazed on their range, own their trading post, and carry on a coöperative marketing project. The fine cattle herds of the San Carlos Apaches in Arizona attract buyers from great distances for their periodic sales.

The Metlakatla Indian community in Alaska has its land and sea resources protected by a reservation. These Indians catch fish and own and operate a modern cannery and a hydroelectric plant. They rebuilt a tribal sawmill and constructed comfortable homes from the wages and profits of their businesses. Since the passage of the Alaska Welfare Act in 1936, the villages of Hydaburg, Klawock, Kake, and Angoon have borrowed money and purchased canneries.

Loans to Indian groups have proved an excellent credit risk. They have repaid more than 99 per cent of the funds borrowed.

Indian Activities outside Reservations

Each year a substantial number of Indians leave the reservations to seek employment elsewhere. The number is largest in prosperous times. When times are hard, and Indians are laid off, they return to the reservations. Though most of the urban Indians maintain close family relationships with reservation friends and relatives, they rapidly merge with the city people.

In Oklahoma, where Indians have had education and other assimilative influences longer, the majority have blended effectively with the rest of the population. Indians are found in the state legislature and in Congress. They serve as justices in the courts, as lawyers, doctors, teachers, and successful businessmen. The "rich" Indians of the Cherokee and Osage tribes, on whose lands oil was found a generation ago, are few in number and quite an exception to the general economic level.

Indians made outstanding records in the two world wars. Some 8,000 enlisted during the first World War, though they were not subject to the draft. In the second World War, about 25,000 served, including several hundred young women in the WAC. Especially notable service was given by Navajo marines who relayed orders in their tribal language. The enemy could not "break" this code. A number of Indian heroes received awards for bravery in both wars.

Services of the Bureau of Indian Affairs

The two largest appropriations in the Indian service are for education and conservation of health. The Branch of Education operates 241 day schools, ranging from one-room rural schools to 500-pupil elementary

and high schools, and 90 boarding schools. Since 1928 the high schools have increased from 2 to 33. About 20 per cent of the graduates enter college. In the first 15 years after passage of the Reorganization Act, more than 2,500 students obtained loans for college work.

The hospitalization and disease-prevention work of the Health Branch of the Indian service has contributed greatly to the improvement in health and to the lowering of the death rate among Indians. Tuberculosis, the chief scourge of the Indians, has been decreased greatly. The eye disease, trachoma, which formerly afflicted as many as 20 per cent of some tribes, has been wiped out in most areas. The Indian population grew from 244,437 in 1920 to 393,622, according to an Indian service census of 1945.

Some 64 hospitals in the continental United States and 8 in Alaska are operated by the Health Branch. They care for some 60,000 patients annually. Indians who are financially able are expected to pay for medical, hospital, and dental services.

Construction and operation of irrigation projects are important phases of the bureau's work, since much Indian land is dry. Water has been brought to more than 800,000 acres, and new projects are being built.

Indians and Eskimos of Alaska

More than a third of the inhabitants of Alaska are of Indian stock. Of these, 15,716 are Eskimos, 5,649 Aleuts, and 11,385 Indians. Federal supervision of their affairs is carried on by the Alaska Native Service, a branch of the Bureau of Indian Affairs.

Day schools are operated in almost 100 villages, and there are boarding high schools, hospitals, health centers, and tuberculosis sanatoriums. Villages have financed stores, canneries, and fishing boats under the Alaska Welfare Act.

Canadian Indians Today

In Canada's Far North, vast areas are virtually uninhabited. Here the Indians may roam about, hunting, fishing, and trapping, much as their forefathers did. Elsewhere most of the Canadian Indians live on reserves. All reserve land is community property. An Indian has the right to occupy and use the land, but he can own only the improvements he puts on it.

The Indian Affairs Branch of the Department of Citizenship and Immigration administers Indian affairs. It co-operates with the missions of various churches in educating the Indians. Usually the branch builds the schools and then contracts with a mission board to conduct them.

The Indian Affairs Branch carries on projects to aid the Indians in earning a livelihood. Instructors teach modern farming and stock raising methods. Sawmills handle timber logged on reserves. Fur-bearing animal sanctuaries are set aside and fur conservation practices are taught the many trappers.

Indians living on a reserve are not eligible to vote, with the exception of veterans of the two World Wars. Indians not on reserves may apply to the government for the right to vote. After they are enfranchised, they lose their special rights as Indians.

BIBLIOGRAPHY FOR INDIANS

Books for Younger Readers

Aulaire, I. M. and E. P. d'. Pocahontas (Doubleday, 1946).
Baity, E. C. Americans before Columbus (Viking, 1951).
Beatty, H. B. Little Owl Indian (Houghton, 1951).
Bleeker, Sonia. Indians of the Longhouse; Apache Indians; Sea Hunters (Morrow, 1950–51).
Brewster, Benjamin. First Book of Indians (Watts, 1950).
Brindze, Ruth. Story of the Totem Pole (Vanguard, 1951).
Buff, M. M. Dancing Cloud, the Navajo Boy (Viking, 1937).
Clark, A. N. In My Mother's House (Viking, 1941).
Hunt, W. B. Indian and Camp Handicraft (Bruce, 1945).
McSpadden, J. W. Indian Heroes (Crowell, 1950).
Marriott, A. L. Indians on Horseback (Crowell, 1948).
Mason, B. S. Book of Indian-Crafts and Costumes (Barnes, 1946).
Salomon, J. H. Book of Indian Crafts and Indian Lore (Harper, 1928).

Legends and Stories

Armer, L. A. Waterless Mountain (Longmans, 1931).
Bannon, Laura. When the Moon Is New (Whitman, 1953).
Bronson, W. S. Pinto's Journey (Messner, 1948).
Brown, Paul. War Paint, an Indian Pony (Scribner, 1936).
Bulla, C. R. Eagle Feather (Crowell, 1953).
Clark, A. N. Little Navajo Bluebird (Viking, 1943).
De Angulo, Jaime. Indian Tales (Wyn, 1953).
Fenner, P. R., ed. Indians, Indians, Indians (Grossett, 1953).
Hayes, F. S. Chee and His Pony: the Story of a Navajo Boy (Houghton, 1950).
Hooke, H. M. Thunder in the Mountains (Oxford, 1948).
Kenton, Edna. With Hearts Courageous (Liveright, 1948).
Lenski, Lois. Indian Captive; the Story of Mary Jemison (Lippincott, 1941).
Marriott, A. L., comp. Winter-telling Stories (Sloane, 1947).
Martin, F. G. M. Nine Tales of Raven (Harper, 1951).
Olds, Elizabeth. Feather Mountain (Houghton, 1951).
Prescott, J. B. Meeting in the Mountains (Longmans, 1953).
Running, Corinne. When Coyote Walked the Earth (Holt, 1949).

Books for Advanced Students and Teachers

Appleton, L. H. Indian Art in the Americas (Scribner, 1950).
Coblentz, C. C. Sequoya (Longmans, 1946).
Collier, John. Indians of the Americas (Norton, 1947).
Douglas, F. H. and d'Harnoncourt, René. Indian Art of the United States (Museum of Modern Art, 1949).
Embree, E. R. Indians of the Americas (Houghton, 1939).
Fuller, Iola. Shining Trail (Duell, 1951).
Garst, D. S. Chief Joseph of the Nez Percés (Messner, 1953).
Garst, D. S. Crazy Horse, Great Warrior of the Sioux (Houghton, 1950).
Hannum, A. P. Spin a Silver Dollar; the Story of a Desert Trading Post (Viking, 1945).
Huntington, Ellsworth. The Red Man's Continent (Chronicles of America Series) (Yale Univ. Press, 1921).
McNickle, D'Arcy. They Came Here First; the Epic of the American Indian (Lippincott, 1949).
Marriott, A. L. Greener Fields (Crowell, 1953).
Martin, P. S. and others. Indians Before Columbus (Univ. of Chicago Press, 1947).
O'Kane, W. C. The Hopis (Univ. of Okla. Press, 1953).
Parkman, Francis. Oregon Trail (Globe, 1953).
Radin, Paul. Story of the American Indian (Liveright, 1944).
Santee, Ross. Apache Land (Scribner, 1947).
Schmitt, M. F. and Brown, Dee. Fighting Indians of the West (Scribner, 1948).
Underhill, R. M. Red Man's America (Univ. of Chicago Press, 1953).
Vestal, Stanley. Warpath and Council Fire (Random, 1948).
Wissler, Clark. Indians of the United States (Doubleday, 1940).

A list of valuable pamphlets is available from the U. S. Indian Service, Haskell Institute, Lawrence, Kan.

INDIGO. For centuries the much-prized blue dye called indigo was obtained exclusively from the indigo plant, and the indigo trade with India and other centers of production was flourishing and prosperous. Today the natural indigo trade has dwindled to a fraction of its former importance because scientists have discovered a means of making artificial indigo.

The story of artificial indigo is one of the most interesting in the history of chemistry. It took 17 years of tireless experiment and the expenditure of nearly $5,000,000 to perfect the process. As early as 1880 a German chemist, Adolf von Baeyer, produced synthetic indigo from coal-tar products, but the cost of production was much greater than that of the natural dye. From then until 1897 he and others worked on the problem of making indigo by less expensive processes and finally succeeded in producing it at less than half the cost of the plant dye. There is still a steady demand for the natural indigo, when certain "fast" blues are wanted (*see* Dyes).

Most vegetable indigo comes from a shrubby plant three to five feet high, with rounded leaves and pale red flowers, belonging to the bean family. When three months old and in blossom, the plants are cut down, but soon shoot up again and yield a second and often a third cutting in one year. The cut stems and leaves are crushed and soaked in water for several hours. Fermentation takes place. Then the water, which is clear yellow, is run off into another vat and stirred. Indigo begins to form in bluish flakes on contact with the air and settles. It is filtered through linen, molded into small cakes, and dried for shipment.

The best quality comes from Bengal. Indigo plants are also grown in Java, China, Ceylon, Mexico, Brazil, and Central America. For a time there were large plantations in South Carolina and other Southern states. The scientific name of Bengal indigo plant is *Indigofera sumatrana*. In China an indigo dye is obtained from a plant known as *Polygonum tinctorium*.

INDIVIDUAL DIFFERENCES. Although people appear to be alike in many ways, no two individuals are exactly the same. Even identical twins are not absolutely alike, although they resemble each other more than fraternal twins or other brothers and sisters.

People differ in eye-color, height, strength, agility, and speed. These differences are *physical* and can usually be seen at a glance. People also differ in such *mental* traits as word fluency, verbal comprehension, reasoning power, learning ability, and emotional response. These are difficult or impossible to evaluate by observation alone.

The scientific study of individual differences is called *differential psychology*. It investigates such problems as the causes of individual differences; the nature and extent of individual differences; and how individual differences are affected by training and other environmental conditions.

Causes of Individual Differences

Various investigators have proposed either heredity or environment as the chief cause of differences in both physical and mental traits. We know that many physical traits, such as the color of eyes or hair, height, round or long head, and the like, are inherited (*see* Heredity). But bodily development is affected by environment as well. Improved nutrition and health conditions in the United States, for example, are making modern young people grow taller than their parents.

We know also that to some degree intelligence is inherited. What a child makes of the heritage, however, will depend upon how much opportunity, help, and stimulation are provided by his home and school.

Today psychologists agree that there appears to be an *interaction* between heredity and environmental influences. This means that differences in the environment, even though small, together with differences in heredity produce observed differences in characteristics. Training is a powerful tool for modifying human behavior, but it is effective only within the limitations of the inherited make-up of the individual.

Individual Differences and Education

Recognition of individual differences is important in modern education. Teachers realize that children cannot and should not all be trained in the same way. Differences in aptitudes, interests, intelligence, and personality are recognized in planning school programs, in selecting textbooks, and in working out ways of teaching the various school subjects.

It is also important to take into account the stage of development of each pupil. Children go through the same general sequence or pattern of growth, but they progress at different rates. A child does not become able to read because he has a sixth birthday and enters the first grade in school. Whether he can read depends on whether he has acquired "reading readiness" during his preschool years. (For further details, *see* Reading.) At any given age, normal children may vary by as much as five years in the development attained. (*See* Child Development.)

Forcing children to undergo instruction in reading or any other school subject before they are ready leads to frustration and often to failure. Versatility, both in teaching method and in subject matter, is extremely important if education is to meet the needs of individual students and prepare them to take their places in society.

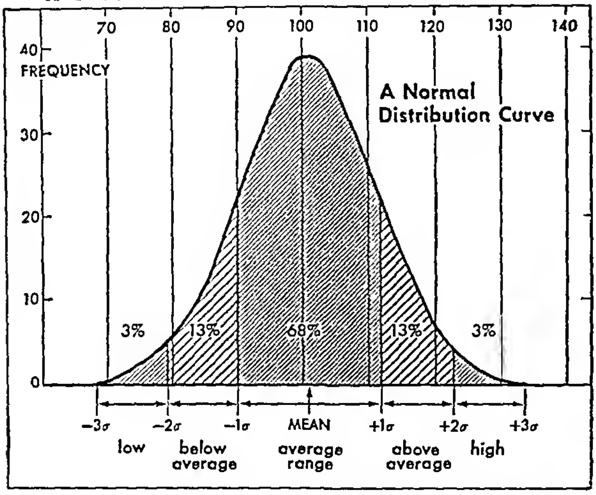
Measuring Individual Differences

We cannot know wherein people differ until we have some quantitative method for measuring differences. Evaluations by observation alone are subjective and unreliable.

The first systematic measurement of individual differences came when astronomers began using telescopes. As part of their work they watched when each star crossed the meridian and then pressed a key to record the time. They noticed that observers varied in the time they took to see the crossing and press the key. Psychologists became interested in these variations in *reaction-time* and began to study individual differences in other reactions of men and women.

Sir Francis Galton, a distinguished English scientist of the 19th century, devised and set up a labora-

A NORMAL DISTRIBUTION CURVE



This bell-shaped curve of intelligence test scores is typical of the distribution of almost all measurable human traits. The majority are average or close to average, with few extremes.

tory in London to test individuals for sensory discrimination, such as their capacities to see, hear, and feel; their motor capacities; and other simple processes (*see* Biometry).

James McKeen Cattell, a 19th-century American psychologist, pioneered in designing tests of differences in psychological traits of individuals. Many tests of mental capacity and scholastic achievement were developed during the first half of the 20th century. Some examples are: intelligence tests, attitude scales, personality inventories, aptitude tests, rating scales, and psycho-physical measurements. Today these are used in schools and in industry, for the scientific investigation of individual differences, and also for practical application to many problems in the guidance, placement, and training of people. (*See* Intelligence Tests; Psychology.)

Information Sought by Testing

Several approaches may be made to the problem of identifying and measuring individual differences, depending on the information desired. One method is to compare individuals in respect to a specific trait. Each individual can then be placed somewhere on a continuous scale of measurement which permits identification of "smallest," "average," "largest," "more than," "less than," and so on.

Thus a basketball coach might be particularly interested in the heights of boys in his school. He is probably looking for those who are very tall. An employment manager, on the other hand, might be interested in selecting individuals who are very short. He may be looking for people to train for welding or assembly work in cramped spaces in airplanes or ships. However, some of the tall boys will not have the speed and co-ordination for basketball, and some of the short boys will not have the mechanical aptitude or dexterity to be welders or assemblers. It will be necessary, therefore, to apply additional tests in order to obtain the desired aptitudes combined with the desired physical characteristics.

A second approach is to study the variation of abilities within a single person. Is he good or poor in everything he does? If he has high mechanical aptitude, does it necessarily follow that he has either high or low clerical aptitude? If he has the interests for a particular occupation, does he also have the aptitude and the temperament for it?

Many studies have shown that the abilities of a person are not equal. He is better in some things and poorer in others. Because he is high in one thing, however, does not mean that he will necessarily be low in something else. A person who has poor vision does not invariably have exceptionally acute hearing. Usually his abilities tend to cluster around his own average, but he may also have widely separated strengths and weaknesses. Efficient education and guidance capitalize on assets and potential strengths rather than on attempting to overcome weaknesses.

The Danger of "Typing" Groups and Individuals

A third approach to the problem of individual differences is to study the characteristics of persons who belong to various categories or groups. People who are members of a particular race, nationality, or social group *may appear* to have certain characteristics in common which distinguish them from members of other groups. Before we can "type" people, it is necessary to study individuals in the various groups and demonstrate that *as a group* they really are different. Do primitive people have better vision and hearing than civilized people? Are men better at mechanical work than women? Are members of one race more musical than those of another?

The results obtained so far indicate that differences between persons *within* the groups are far greater than the overall (average) differences from group to group. This casts great doubt on the common practice of many people to label the members of a group with the same descriptive term to imply that they are all alike. It also means that we must always deal with the members of social and racial groups as unique personalities, even though they may appear to have many beliefs, attitudes, and behavior in common.

Many studies of individuals and of groups demonstrate that there do not appear to be pure types; that continuous gradation with many individuals near the average is the rule. Anyone who has seen a large group of people lined up according to height is aware of the fact that there is a continuous gradation in height from very tall to very short. There are no pronounced "types" with gaps in between. The majority of persons are average or close to average in height, and as the extremes are approached there are fewer and fewer cases. It is much more difficult to find a man who is six feet seven inches tall than one who is five feet ten inches tall.

The same distribution is true for practically all other traits and characteristics. There are relatively few gifted persons and relatively few feeble-minded persons. Between these two extremes is a continuous gradation, with a large "bunching-up" of people near the middle.

AMERICA'S *Precious* HERITAGE *of* FREEDOM

Every American enjoys a priceless birthright. The Americans who lived before him, Lincoln, pioneers like Daniel Boone, Washington, and the colonial fathers have given him the gift of freedom, beyond any measure known in other times or lands

INDIVIDUAL FREEDOM. As long as Americans live in their free nation, they seldom ask what freedom means to them. They were born in freedom, they grow up in it, they expect it. But when war sent young Americans into foreign lands, they began to appreciate freedom. They saw how people live in lands of old customs and in lands trying experiments. They saw, and longed for their America—land of individual freedom. Only America gave them the choices and opportunities they had always taken for granted.

Perhaps they did not think of American life in terms of "individual freedom." They just knew that "back home" they had the right to choose public or parochial school, the right to follow their own religion. They remembered that in America the government did not own the press or the radio. No one told them what newspapers or magazines they could read, what radio programs they must hear Back home *their* government did not force them to labor in a certain factory, enter a certain trade, or stay on a farm. They could even try to build a business of their own. Finally, *their* government belonged *to them.* They could criticize it without being jailed. They could support its good measures and work to improve it.

The Nature of American Freedom

Now study these privileges. They are *not* substitutes for work or effort. They do not automatically provide everyone with easy, comfortable living, wisdom, or happiness. They provide the opportunity to win these blessings.

This freedom is relatively new and not yet perfect. The opportunities it gives do not yet reach all people. But the spirit of freedom still works for those who live under handicaps, just as it did for Americans of an earlier day. Today the problems are much less difficult because the pattern of freedom has already been laid. And it rests upon foundations that are broad enough to support all the fundamental rights of man. These foundations are: freedom under government, freedom in business, and freedom in education, speech, and religion.

American Roots of Freedom

FREEDOM as men know it under American government is indeed new. It has come to us only after men struggled for centuries to exercise their right to be free, to throw off the fetters of tradition. Throughout most of the world's history men had lived their daily lives under rigid rule. From birth to death, primitive people obeyed tribal custom and taboos. As civilization arose, despot kings held the power of life and death over their subjects.

Sparks of freedom arose in the limited democracy of Greece and in the law courts of Rome, but soon died. In the Middle Ages merchants gained some business rights, but the peasant remained in bondage to his feudal lord. Still, new vision and courage gradually emerged. The spread of Christianity began to undermine the ancient idea that men were merely servants of the state. Christianity preached "the importance and dignity of the individual," that a man had reason and a conscience and so the right to live his own life. Then the bold discoveries of whole continents opened new chances to break bonds. When the old ruling classes continued to hold men fast in Europe, a sturdy and determined few quit the Old World for

the fresh New World, where they could nurture the seeds of freedom.

The Fight for Free Government

To do so, they had to conquer a wilderness, fight some six years of Revolution, and build their own nation on a raw continent. That is what they did to earn freedom, to earn the chance to think and act for themselves and enjoy the fruits of their own labor and risks. The history of Colonial and Revolutionary days shows how dearly they paid for it.

These Americans knew how hard freedom was to earn. They were not going to treat it lightly. To safeguard it they created a new kind of government. They wrote the Constitution of the United States, with the Bill of Rights—the first government in history to serve not the state but the people. In the Constitution the people gave themselves the power to make their own laws.

Building Freedom of Opportunity

Those American men and women of earlier, hard days had the strength and self-respect and vision of a free people. Because they were free they knew they could work out their own destiny. Their tools were courage, work, and risk—the tools of free men.

They created "the land of opportunity," and it became a haven for the oppressed of other countries. These new immigrants added their strength and skills to the young nation, helping to speed its development.

As the work went on, Europeans explained American success by saying the land had immense natural advantages—vast resources of fertile land, minerals, timber, water power. They were right, but it was the American people who *developed* these advantages. Fertile land must be cleared and farmed efficiently. American farmers did it. Arid regions are barren until engineers build dams and harness rivers to make irrigated cropland. American engineers did it. Petroleum, coal, iron, and water power lie unknown and unused until men discover and employ them. Americans were and are ever on the search. Should other nations begin to search as vigorously, they may find unknown reserves greater than America's. But, like America, they must first get the will and the skill.

Free Speech, Religion, and Education

When they founded their nation, the colonial Americans were determined to match freedom under government and in business with freedom of spirit and conscience. They knew that no people could be free unless it could speak its mind. In the Bill of Rights they forbade their government to interfere with freedom of speech or freedom of the press.

Nor can a man be free unless he can worship as he believes. So the founders of the nation provided for freedom of religion. To make sure, they forbade their government to establish or favor any one religion or creed above another.

But these rights might mean little unless the people had the intelligence and knowledge needed to use them wisely. So Americans came to see that education, *free* education for everybody, was a necessary cornerstone of democracy. As the nation grew, people demanded more educational facilities. States and communities began to provide free education for *all* children. The government gave a vast empire in land to be used or sold for support of schools and colleges.

Changing Character of Freedom

IN THIS spirit the American people started to build their nation. They had one burning denial of freedom in their midst, the existence of human slavery. But the people fought a ravaging war to end this injustice.

Meanwhile, other problems arose. Small shops grew into huge factories. Business passed more and more under control of corporations, many of giant size. The supply of good free land for ambitious settlers dwindled, then virtually disappeared. Farmers began to specialize and became dependent on stores for many of their needs. In turn, growing cities became ever more dependent upon agriculture.

All this increasing interdependence ended the broad simple freedom of pioneer days when "every man was his own boss." But the American people moved to meet the threats to freedom. When monopolies arose, the people wielded their power of making laws and established government regulations of business. Another important change came in labor-management relations. In many large enterprises, face-to-face bargaining between individual employees and employers gave way to unions bargaining with corporations and sometimes with even whole industries.

Progress in the American Way

Many problems still exist, and just solutions for them must still be found. Often it is easy to think only of grievances and difficulties, and forget that meanwhile progress has been made—more than has been achieved in any other country at any other time in history.

One proof is the American standard of living. The United States has only about 6 per cent of the world's population, yet its people have 75 per cent of all the automobiles, 54 per cent of the refrigerators, and 50 per cent of the radios. The United States leads the world in industrial equipment. Americans have more, yet work less than other people, as shown in a comparison of purchasing power made just before the second World War. To earn a day's food for a family of three children and two adults, workers in various countries had to labor the following number of hours:

United States	1.6	Germany	3.9
Great Britain	3.2	Italy	6.2
France	3.2	Russia	10.0
Belgium	3.6		

Working hours likewise have gone down as purchasing power has gone up. The colonial day of work from dawn to dark gave way to the 10-hour day in the 19th century. From that level the work week went to 48 hours. Today the 40-hour week is common.

Gains in Education

The same mixture of problems and progress appears in education. But many problems are caused by the very size of the task the American people have set as their goal.

Grade schools and high schools are crowded today, and short of teachers. Against this set the number of children to be educated, and particularly the number at higher levels. Today American high schools have more pupils than are found in the high schools in all the rest of the world.

So it is in other provisions for mind and spirit. Distribution of books, libraries, parks and playgrounds is not perfect; but it is incomparably better than has ever been provided elsewhere for any similar number of people. Behind all this stands the American record of invention and research to find better means for living, conquering disease, prolonging life, and improving health. World leadership in science has come to America because only America has the means and can spend millions or even billions in search of better ways.

Outlook for the Future

THE FUTURE holds wide promise, for freedom breeds self-reliance and vision. That is why America is a country of never-ending frontiers. The land frontiers are gone, but today's new frontiers are in education, science, and industry. When one industry is outmoded, another thrusts up to take its place. Not long ago men had not heard of rayon or cellophane, nylon or foam rubber, vitamins or frozen foods, aluminum, nitrogen from the air, magnesium from the sea, antiseptics from coal tar and mold. Yet in one generation each such discovery created a new industry, giving employment to thousands. Not all were discovered in America, but American energy and vision developed them highly. One recent discovery in America promises to be the richest frontier ever known in science and industry—the frontier of atomic energy.

This, then, is the land built in freedom, the United States of today. It has faults, but it has promise too, more promise than is offered by any other way of life. What will be done to turn promise into reality depends upon how the Americans of today and tomorrow use their heritage of freedom.

Freedom is a hard-won prize. We have to work to keep it. Let a people become indifferent or greedy and that people is in danger of losing freedom. Our own time has given examples. Between World Wars, indifference and class greed undermined France and it collapsed. In Italy and Germany, blind desire for security led men to accept dictators' false promises.

Freedom demands responsibility. It demands courage and hard work. It demands knowledge, thinking. It does not promise equal gains for all. It promises only equal rights, equal risks. Does it demand too much and promise too little for what we get? Would we get more and get it easier if we permitted the state to think and to act for us? Read about people in lands controlled by the state. Read about Communism or Fascism. In such lands has labor the right to bargain, has the employer the right to sell where and how he chooses, has the worker the opportunity to change jobs or set up his own business?

Individual freedom is ours only as long as we earn it. The work starts in our own actions. We can keep freedom by respecting the rights of others—family, neighbors, community, and minority groups in race, religion, and politics. And rights mean personal rights, property rights, religious rights, political rights.

To guard freedom, each of us must invest some time in studying our government. Few laws are perfect, yet *we* voted them. It is our duty to obey them but it is also our privilege, as a free people, to improve them.

To guard the resources of our land we must practise conservation. To hold business freedom we must see that labor and capital are sound partners. We must find ways to improve distribution of the masses of goods we produce. We cannot be smug about what we *have* done through freedom. Instead, we must be alert to our opportunities to improve. That is the chance that freedom gives us.

We have now traced the main trails that men blazed to freedom. In the following Reference-Outline we follow that struggle through the centuries and see the breadth of the future.

INDIVIDUAL FREEDOM . . . *an Outline*

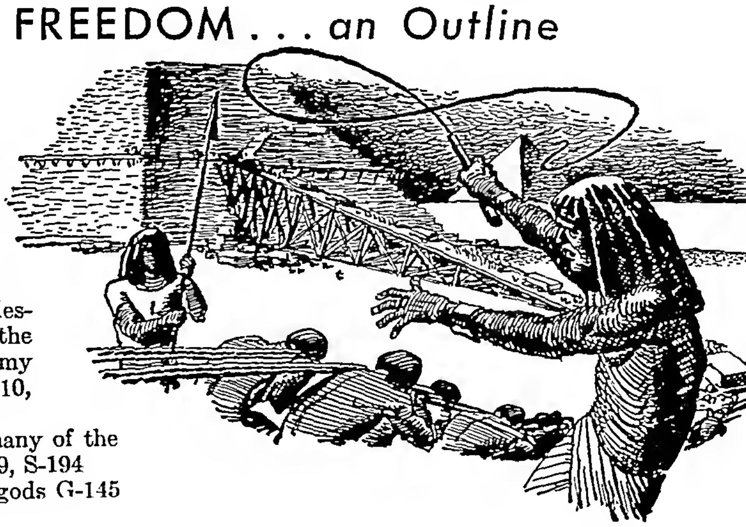
I. ANCIENT PEOPLES LIVED IN BONDAGE

FOR *thousands of years men plodded the blind way of custom and despotic rule.*

A. Primitive man bowed under superstition and taboos M-33-6

B. In "anthill" states of the ancient world, despots could seize men from the plow, the potter's wheel, and lash them into the army or work gang B-8, E-279-80, R-184, I-110, pictures A-312, S-195

1. In even the most enlightened states many of the people were helpless slaves D-63, G-199, S-194
2. Warrior kings arose and became like gods G-145



II. THE FIRST SEEDS OF FREEDOM

In *the dark soil of autocracy, daring ideas of independence begin to grow. Perhaps all men could reason.*

A. Greek philosophers usher in age of reason G-145, G-196, 202, W-209

B. The laws of Rome provided legal rights for citizens and later for all people R-182-4, L-139, W-210

C. Christianity heralded the dignity of the individual C-301, W-210, I-115

III. THE MIDDLE AGES NURTURE THE ROOTS

The *Middle Ages provide history's greatest paradox. During that strange period most men lived in serfdom, yet the Crusades brought new freedoms in trade, new hungers for better living, new quests for independence.*

A. Feudalism held all in bonds—serfs, villeins, and even suzerains F-60-2, S-196

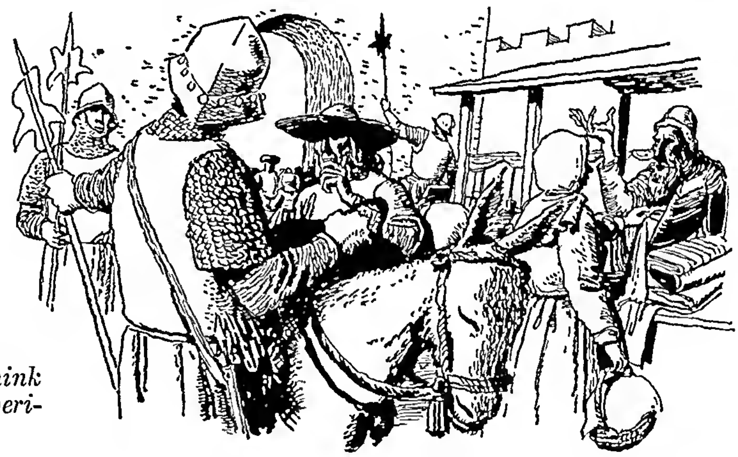
B. Feudal life did not encourage new ideas
1. Farming was primitive A-70-1, F-61, S-196
2. Nobles made pleasure a career K-55, M-238*a-c*
3. Monks guarded classic manuscripts, but few students gleaned the knowledge E-246, M-238*d*, M-356

C. Then the Crusades revealed the East C-519-22

D. New products and the spread of trade shake the fetters of feudalism
1. Traveling traders circulate new goods and new ideas T-165, F-11-12, P-364, R-107
2. Commerce builds towns and demands manufactures C-324, R-107-8
3. Workers form guilds, leagues G-228, H-260-1
4. Strong cities set up own rule C-324, D-64

E. National governments arise A-496, E-359-61, E-432, F-62, F-268, S-321
1. Nobles curb tyranny D-64, M-41
2. Courts uphold civil rights C-501, H-335, J-366-7
3. Kings give commoners rights M-238*h*

IV. FREEDOM GROWS AS NEW DISCOVERIES ARISE



The *idea that men should dare to think and act for themselves kindled experiment and discovery.*

A. Classical knowledge is reborn R-103-8
1. Stimulus of Greek, Roman manuscripts R-104
2. Schools increase E-249-50
3. Invention of printing helps T-229-30, P-414*c-d*
4. Scientists explore nature's "mysteries" A-443-4, A-239, B-11-12, C-220-1, P-231

B. Explorers find "the world"
1. Mariners seek the fabulous Indies R-108, C-427-8 H-340, G-7, M-31, E-201
2. Mariners touch the New World A-187-91, C-416-19
3. People of the Old World find freedom in the New A-192, P-325, S-276

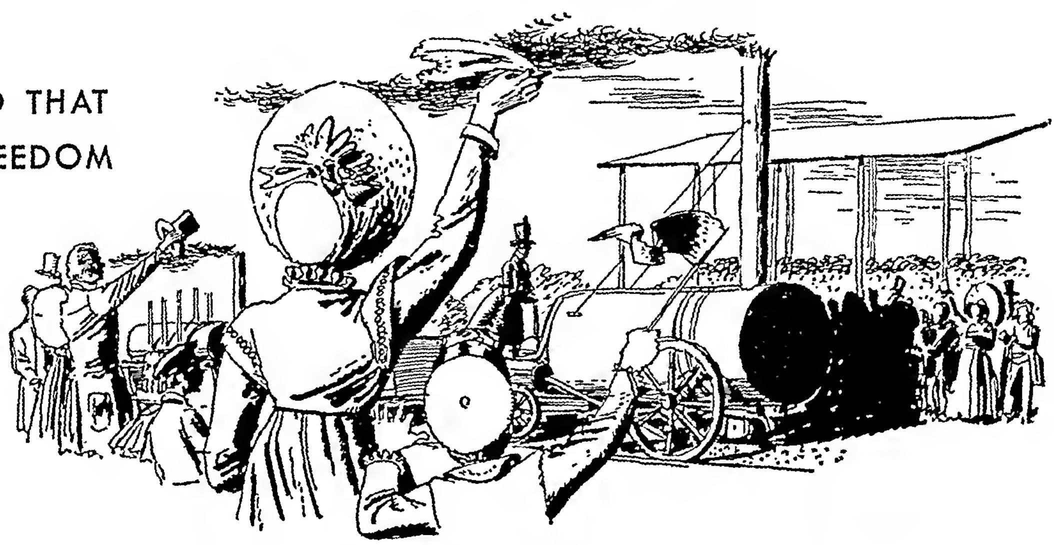
C. In the Old World, Europeans push aside some barriers
1. Men win representation in government D-65, P-88, B-145, C-191: the French Revolution spikes tyranny F-291
2. Britain's men create machines for the Industrial Revolution I-131-2, S-390, W-74, E-369*a*, H-269
3. Laissez faire stirs business I-130, I-133

D. Beginnings of freedom enable Europe to surpass Asia A-404

V. THE LAND BORN IN FREEDOM

In *the New World there were no man-made barriers. Our new land raised no stifling customs, laws, ruling classes. For the first time in the history of the world, freedom became a birthright. To keep it, Americans built their own nation. The reach and grasp of their courage stand forth in the Outline on The American Heritage on pages 218-23 in the A volume of Compton's.*

VI. THE LAND THAT GREW IN FREEDOM



The *progress of the new nation amazed the Old World. Europeans stared at a new people who grappled problems with their own hands and minds. These astounding people created a free, representative government. They created a way of life fashioned by toil and patterned for opportunity. They built the world's most powerful nation.*

A. Wakening the sleeping riches of the land U-245
  1. Fertile soil and minerals, thick timber and water power: the soil U-316, L-91; sinews of metal U-245, U-319-20, I-246-7; coal C-361; black gold P-168; forest masts F-236, U-318; white roar of power W-67, U-251, map U-256-7
  2. They slashed through deserts and mountains U-291, P-261-70, A-58-9, F-38-43, F-321, L-176, U-373-5

B. Rewards of freedom give incentive to risk, toil
  1. Immigrants ventured the sea I-45-7, I-115-16
  2. Merchants warred and ventured capital to expand trade R-124, T-166
  3. Manufacturers build mills U-377, C-437-8
  4. Mines and sawmills develop U-251
  5. American ingenuity whips vast distances T-170*e-f*
     a. Pioneers devise the Conestoga wagon F-40
     b. Shipbuilders devise clippers S-150, picture S-153
     c. "Dreamers" build canals T-171-2, C-108*b*, U-376
     d. Fulton develops the steamboat F-315
     e. Engineers build webs of rail T-172-172*a*, R-59-60
  6. New developments arise I-116
     a. Americans lead in invention I-117, I-201
     b. Cotton gin opens a new era W-132, C-497
     c. Howe's sewing machine sets up clothing industry H-436, G-23
     d. McCormick's reaper mechanizes farms M-5, R-85, A-59
     e. Morse's telegraph spans the world M-395, T-36
     f. Bell's telephone breaks isolation B-121, T-44
     g. Carnegie and Kelly give America unrivaled strength in iron and steel I-246-7, C-124
     h. Edison tames electricity E-309, E-235
     i. Automobile opens new industrial fields A-500
        (1) Ford develops mass production F-234
        (2) America builds highway network R-158
        (3) Petroleum's giant industry P-168
        (4) Rubber's riches R-237
     j. Wright brothers invent the airplane W-309, A-102
     k. De Forest and Armstrong perfect radio D-46, R-43
     l. Expanding business creates new wealth U-314-16, H-274-5, E-223
        (1) World markets open T-166, I-192-3
        (2) Specialization in production and distribution spreads employment E-227, chart E-225
            —Salesmanship and advertising broaden markets I-140-1, A-23
        (3) Thousands invest savings in corporations, buying stocks and bonds C-487, E-224, S-398-400
        (4) Mergers produce huge trusts and monopolies M-359, A-392, H-275, M-18-19
        (5) Able business organizers build fortunes A-392, H-275, M-19: Wanamaker and Field in merchandising H-274; Rockefeller in oil R-170; Carnegie in steel C-124; Hill and Harriman in railroad building M-19, H-355
        (6) Trade and industry draw people to the cities and America ceases to be an agricultural country U-377, 382, C-323
        (7) Chain stores, mail-order houses, co-operatives, and other new businesses arise I-117, C-469-72, C-181-2

VII. THE FRUITS OF FREEDOM

FREEDOM *makes us work for our gains, and the gains are good. As a nation, the United States has the world's highest standard of living.*

What we enjoy U-387, U-310-14, I-115, 116
1. We work less hours, have leisure L-158-61
2. Education is a boon E-253-5, U-382
3. We can save for the future I-168*a*, B-48, B-53

VIII. THE PRICE OF FREEDOM

KEEPING *freedom puts on each of us an obligation not known to serf or subject of dictator. To keep freedom, an American must be alert and tolerant. "A free country" endures only because its citizens guard human rights and honor "the dignity of the individual." Nor does a "free country" guarantee success to everyone. It guarantees an opportunity of merit—it pledges equal rights and the opportunity to set one's own goal. Here in free America we have natural wealth, and we have the liberty to use it. What we do with it is up to us. Our lives, our country are only as good as we ourselves make them.*

A. Freedom of business makes you responsible for
   1. Choosing your work V-499-515
   2. Making business decisions E-224-6, A-66
   3. Investing in the future T-125-6

B. If you want to keep freedom, you work at it
   1. Obey laws C-319*b*, G-145, P-352-6
   2. Vote D-66, E-288, P-358
   3. Accept duties such as jury service J-365-7
   4. Create intelligent public opinion C-319*c*
   5. Study other government systems which choked freedom and brought world wars W-215-44, W-245-301, G-97-100, F-43-4, F-270-3, J-321, H-383-5, S-215, D-88, R-281, K-65-6

C. Freedom permits us to change, to improve
   1. Americans fight a war to end slavery C-330-37
   2. They write laws to curb monopolies U-383, R-223, M-359-60
   3. They discipline public utilities P-430, I-198
   4. They outlaw bad goods, cheating F-50, P-442
   5. They regulate money, banks B-47, M-338-40, F-49
   6. They study "booms and busts" R-203-9
   7. With their own wages, they set up social insurance S-218-218*a*
   8. And, with their own might of skill, they create co-operative organizations called unions to bargain with capital L-69
   9. They provide social welfare work F-248, S-218*a*, A-223, B-273, C-54, G-113, R-87*b*, A-17, J-368*a*

IX. FREEDOM'S NEW FRONTIERS

IN *our land, men's vision and ingenuity carry them from the old to the new. American science and industry are ever changing, ever rewarding risk, knowledge, and skill.*

A. Chemistry creates new products C-222, N-317-18
   1. Cellulose spins into "silk" C-162-3, R-79-81
   2. Plastics surpass nature P-310-14

B. Science widens man's use of plant life P-303
   1. Chemurgy creates new crop outlets P-303-4
   2. "Plant wizards" improve plants P-305-7
   3. Plants grow without soil P-307-9

C. Minerals crowd the earth M-261, M-267
   1. New methods open the resources M-268-70
   2. "Light metals" create new industries A-168, A-182, 184, M-41
   3. Alloys build the Metal Age A-172-5

D. Medical research becomes giant industry A-265-8, D-156, R-55, R-56, X-328-32, U-233-4, V-494-8

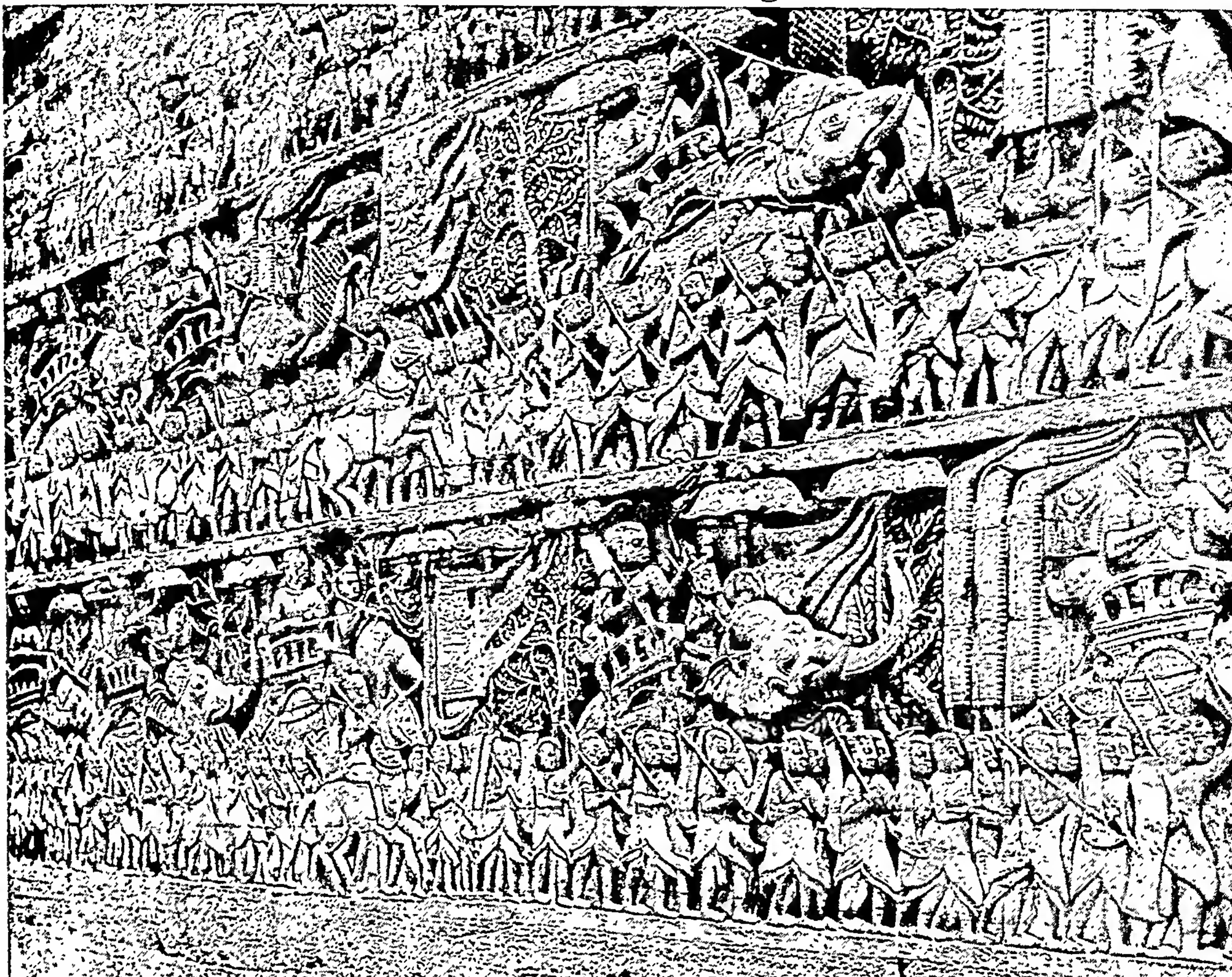
E. Electric power pushes out old boundaries E-309-14, D-6-11*b*, T-69

F. Free education gives Americans knowledge, skill I-116, E-258-63, U-403-4

G. Atomic energy opens a new world A-463-70

H. Rockets and missiles explore outer space G-224, S-309

ASIA'S *Rich Southeastern Finger*—INDO-CHINA



For more than a thousand years these fine carvings have ornamented the temple of Angkor Vat in Cambodia. They show scenes, done in the Indian style, from the religion and history of the Khmers, who occupied the region when the temple was built.

INDO-CHINA. The name Indo-China suggests a meeting or a mingling of India and China. And that, in fact, is what Indo-China is. Almost from the beginnings of civilization, the southeastern peninsula of Asia has been a meeting ground for Hindus and Chinese. "Farther India" it used to be called, but the name Indo-China is better.

Several mountain ranges which slope southeast from the Himalayas make Indo-China a bridge between these two vast regions. One of these ranges extends like a long tendril as the Malay Peninsula. Others divide the land into valleys, with deltas at the river mouths. Protected by these mountains, the valley peoples escaped conquest by their great neighbors.

But they did receive a constant trickle of population, particularly from China. And from both neighbors they took their arts and industries. Hence today we find the Hindu temple near the Chinese pagoda, Chinese plows used to cultivate rice by Indian methods, and many other minglings of Hindu and Chinese.

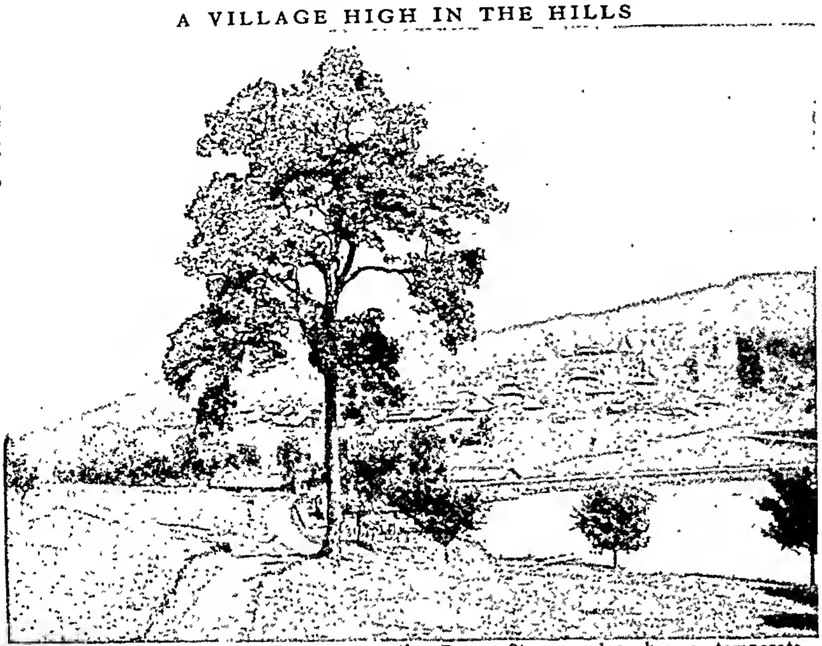
The Land and the People

The peninsula lies inside the tropics and has a monsoon climate. But its range of altitude—from sea level to mountain heights—gives a wide variety of temperature, rainfall, and plant life. Tropical trees and plants flourish in the hot, rain-drenched southern coastal regions and the flooded river plains. Yet some inland regions are virtual deserts. The high hills and mountains have frosts and cool-climate oaks and even evergreens.

In normal times the region is the world's largest exporter of rice, its chief source of tin and rubber, and a rich source of petroleum. Untapped mineral deposits and forests, new crops, and new industries await development. Most of the people are still rooted to the land as peasant farmers, with very low standards of education and living. Industry has been little developed. Both industry and commerce have been almost entirely controlled by Chinese, Indians, whites, and other aliens.

The people are as varied as the land. The chief groups are the Burmese, Thais (Siamese), Malays, Annamese, and Cambodians, with smaller numbers of Shans, Chins, and Kachins. Immigration has brought large numbers of Chinese and Indians. Important trade cities have a sprinkling of Europeans.

A VILLAGE HIGH IN THE HILLS



This village high on the Shan Plateau, near the Burma-Siam border, has a temperate-climate look, except for the steep thatched roofs. The dry climate of the region and the elevation of 5,600 feet keep plant life down to a thin scattering of growth.

Until the European nations seized most of the peninsula during the 19th century, it was divided into many petty kingdoms. Now it consists of Burma, British Malaya, Siam (Thailand), and the Indo-Chinese states of the French Union. All these countries have a total area of about 790,000 square miles and a population of some 67,000,000. Thus the peninsula is nearly half as large as India but has less than a fifth of the population. (For details about countries other than the Indo-Chinese states, *see* Burma; Malay Peninsula; Siam.)

Natural Features of Indo-Chinese States

Nearly a third of the peninsula is occupied by the Indo-Chinese states. Until after the second World War they were colonies in the French Empire. Today they are autonomous members of the French Union. They occupy about 284,000 square miles—about as large as Texas. Their backbone is the Annam Cordillera. This runs from the northwest to the seacoast near Vinh, then along the China Sea. The states lie between the Tropic of Cancer and 10°N. latitude, or about the same as the region from Tampico in Mexico to Panama.

The hilly kingdom of Laos occupies the northwestern and west central parts. The coast region is the old colony of Annam, now Central Viet Nam. In the northeast the old colony of Tonkin, now North Viet Nam, stretches over hilly land and the rich delta of the Songkoi, or Red River. In the southwest an even broader delta reaches toward a knobby upland region on the Gulf of Siam. The delta is Cochin-China, now South Viet Nam. The kingdom of Cambodia occupies the uplands.

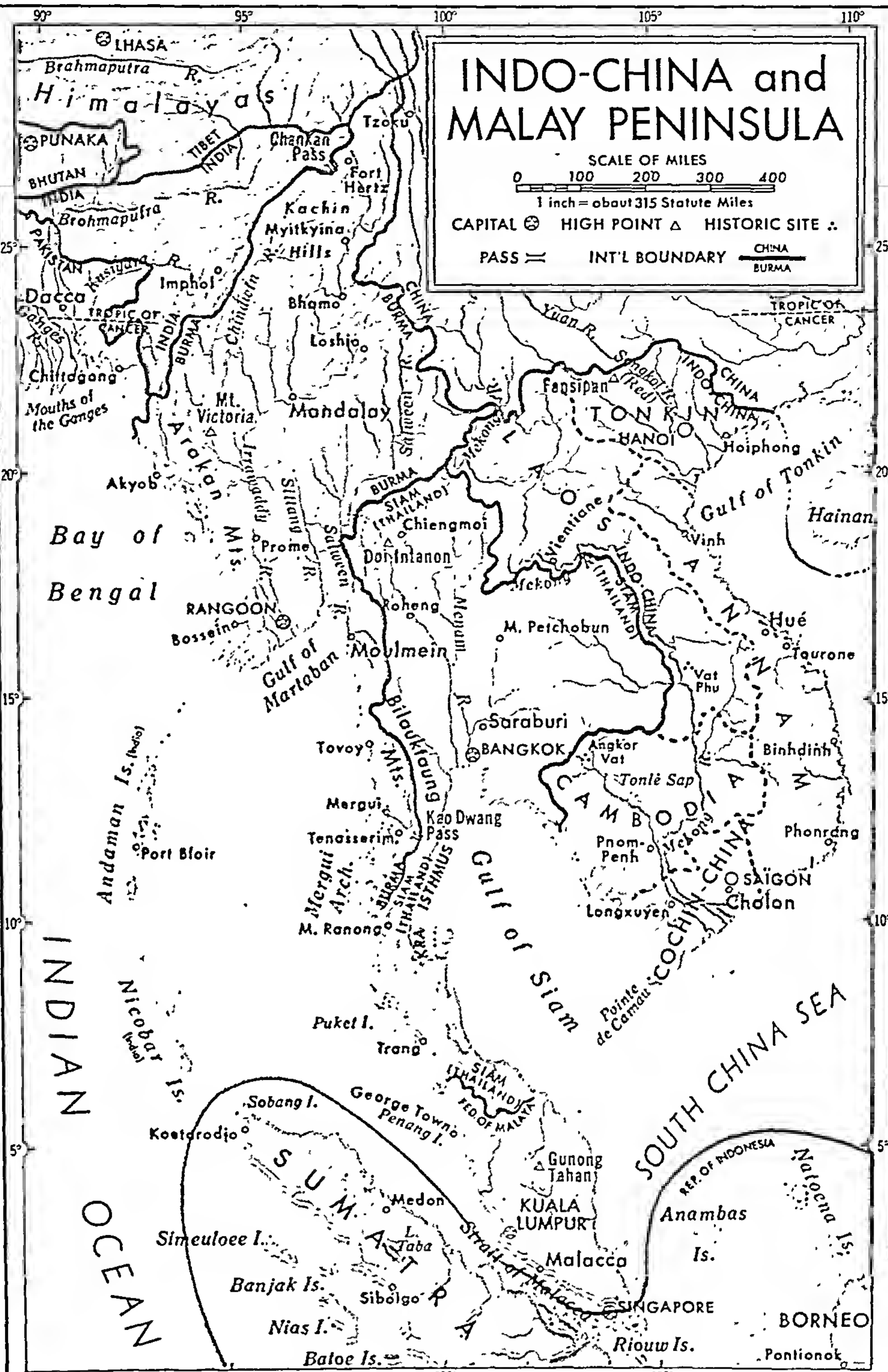
Over all these regions sweep the seasonal monsoons, giving them their climate and plant life (*see* Winds). The summer monsoon blows from the southwest from mid-April to October, bringing drenching rain to the regions southwest of the Cordillera, and a dry season along the China Sea. From October to April the northeast monsoon blows from the China Sea, and the seasons are reversed. On the lowlands the mean temperature is well above 80° or even 90° F. in summer and below 70° in winter. On mountain heights it may fall below 50° or even to nearly 40°. There fires are welcome at night, and frosts occur. Thundershowers and, on the east coast, typhoons provide moisture even in the dry season.

Plant and Animal Life

The abundant rain and heat prevailing throughout Indo-China tend to cover the entire land with a tropical forest of Asiatic trees, except for subtropical growth on the higher mountains. The many kinds of palms include the coco, nipa, and rattan. Timber trees include teak, ebony, and rosewood. Lac, gamboge, strychnine, and chaulmoogra are other forest products. Mulberry trees provide for silk growing. Swampy areas support

PREPARING RICE IN CAMBODIA

To clean rice, these natives pound off the hulls from the natural grain, or paddy, with a mortar and pestle. Then they sieve out the clean grain.



Mountains fan out from the northwest and reach through the Malay Peninsula. Between the mountains are valleys watered by the Irrawaddy, Sittang, Salween, Menam, and Mekong rivers and their tributaries. Most of the people live on coastal plains around the mouths of the rivers. This map shows the historic, natural regions of Indo-China. Their modern names are in the text.

mangrove forests, and bamboo flourishes on all the higher, drier soils.

Animal life includes a rich array of forest birds, insects, and reptiles; in old Annam people eat crocodiles. The forests have tigers, elephants, rhinoceroses, panthers, bears and monkeys. In the mountains are boars, deer, leopards, buffaloes, and small wild horses. The rivers abound in food fish, including the six-foot *pa-leun.*

A Mixed People

The native peoples are basically Mongoloid in race with strong strains of Malay and Hindu. The more important differences among them arise, not from race, but from location and from their past contacts.

The Annamese of old Tonkin and Cochin-China make up about four-fifths of the people. They are short and slender, but with heavy, flat faces. Their writing and customs resemble those of China. The Chams of old Annam show a mixture of white blood, in part from Hindu settlers. The Khmers or Cambodians of the southwest are a puzzling mixture of white and Mongolian. The impressive ruins in the region, especially at Angkor Thom, tell of a vanished high culture of the Hindu type. Scattered among these peoples are Malays, Thais or Siamese, and many Chinese.

Most of the people are peasants, farming small plots near their villages. Only about a twelfth of the total land area is cultivated. More than half is mountainous, and easily four-fifths of the people are crowded into parts of the lowlands where river floods give ample water for rice growing. Nearly a third are massed on the rich Red River delta, working farms of less than an acre. Here population may be as dense as 2,500 persons to the square mile.

Population becomes less dense as the peninsula stretches southward. But the peasants dislike to migrate, even to the better lands of the more thinly settled Mekong delta and Tonlé Sap, the "Great Lake" fed by the Mekong in north central Cambodia.

How the People Live

In most native villages the houses rest on piles to stand above the seasonal river floods. Pigs, chickens,

THE FOREST CONQUERS THE WORKS OF MAN

In the tropical forest, ceaseless effort is needed to keep nature from overwhelming even buildings of stone. Here the octopus-like roots of a fig tree have surmounted an abandoned temple and reared a forest giant over ancient ruins.

and water buffaloes are kept below. Mats or slatted curtains hung from bamboo framework make the walls. The roof is palm-leaf thatch. The well-to-do use teak for timber and have tiled roofs. Furniture consists of mats, boxes, and utensils, arranged in one large room and tiny bedrooms.

Men and women dress alike. When at work, they may wear only baggy trousers or a square of cloth draped as a skirt. Otherwise, they wear a shirt, a knee-length tunic, or a narrow scarf draped around the shoulders or body. Their hats are usually made of palm leaf, shaped like a large parasol or flat and braced with bamboo to carry tea and other loads. This broad, light headgear gives protection against sun and rain. A favorite ornament is an array of brass rings around the neck, wrists, or ankles.

Rice and fish are the chief foods. Corn, millet, beans, sweet potatoes, palm sugar, and some cane sugar are also grown. The chili peppers of Cambodia and Cochin-China are prized for the hot, evil-smelling *nuoc mam*, a sauce made from fish, used daily.

This drab life is colored by traces of the elaborate artistry brought in centuries ago. The simple dress of the Cambodians is of brilliant hues; and their temple dances, performed in gorgeous costumes, are like the famous dances of India. In Tonkin (North Viet Nam) gems and metals and vivid embroideries are worked with the delicate skill characteristic of southern China. And in Tonkin and Annam (Central Viet Nam) even the poorest people carefully make miniature bright garments, horses, and other "worldly riches" out of paper to accompany the spirits of their relatives.

Agriculture, Trade, and Industry

About five sixths of the land is devoted to growing rice. So much of Tonkin, which raises two crops a year, and of Cochin-China (South Viet Nam) is thus planted that they have been called "two baskets of rice hung on the carrying pole of Annam." Tonkin and Annam also raise silk. Foreign-owned plantations in Cochin-China produce rubber, coffee, tea, and some sugar cane. In Cambodia rice shares importance with palm sugar and with fishing, especially on Tonlé Sap. This lake may rise to more than 40 feet at flood time and increase its area from 1,000 to 9000 square miles.

About half of Indo-China's export trade is in rice. Most of it is sent from Cochin-China, for crowded Tonkin needs its own huge crop Other major exports are rubber, corn, coal, tin, tungsten, and other minerals. The chief imports are textile fabrics, petroleum products, iron and steel, raw cotton, and machinery. In times of normal international trade, this commerce is chiefly with France, the British Commonwealth, China, Japan, the Philippines, and the United States. Japan usually buys large quantities of rice, corn, and coal, iron and other minerals.

Mining is an important occupation in Tonkin. This rugged region has most of the mineral resources. It has large deposits of high-grade anthracite coal. It also has iron, manganese, zinc, lead, graphite, phosphates, tungsten, gold, silver, and some tin. Laos, Annam, and Cambodia also have some mineral wealth. Nearly half of the country is forested, but timber is cut on only about a third of the forest land, chiefly in Laos. Teak is the leading timber, and bamboo is widely used.

Manufacturing consists largely of refining native raw materials. Rice milling is most important; other products are silk, cotton goods, glass, cement, vegetable oils, matches, and paper from bamboo. Most of the industries are located in Tonkin.

Cities and Transportation

Hanoi was long the French seat of government for Indo-China. It is built somewhat like a French city, with shaded boulevards and landscaped parks bordered by brick buildings. Its port is Haiphong, an industrial and commercial center. Haiphong stands at the entrance of the Bay of Along.

Saigon is the capital of Cochin-China, and in 1949 it also became the administrative center of the new autonomous republic of Viet Nam. Saigon too is French in plan, with tree-lined boulevards, European stores, and open sidewalk cafés. Situated on the Sai-

gon River and linked with the Mekong by canal, it is a world port. With its large Chinese suburb, Cholon, it is the chief city of Indo-China. Pnom-Penh on the Mekong is the capital and trade city of Cambodia. Hué, capital of old Annam, is small, but it is a royal city of palaces and imposing tombs.

French engineers have built a fine network of all-weather highways to link the principal cities. There are more than 22,000 miles of roads, many of them carrying motorbus lines. An outstanding engineering feat is the extension of the ancient Mandarin Road from the Chinese border through Hanoi and along the entire coast to Saigon and west through Pnom-Penh to Siam (Thailand). Rivers are still the chief means of travel on the flood plains. Ocean steamers can ply the Red River as far as Laokay and the Mekong to Pnom-Penh. River steamers can follow the Mekong as far as Vientiane. About 2,000 miles of railroads link the chief cities.

Indo-China, especially Cambodia, is a splendid source of archeological treasure. The vast ruins of Angkor Thom, a magnificent walled city north of Tonlé Sap in Cambodia, are among the marvels of the world. The city was built by the Khmers in the 12th century and seems to have been abandoned three centuries later, when the Thais of Siam broke the power of the Khmer kings.

Among the impressive ruins is the temple of Bayon, with a high central tower and 50 small, ornamental ones. The red-roofed temple Angkor Vat was built to honor Buddha. A motor road has made the ruins accessible. Yellow-robed priests serve again in its chapels, and dancers trained from childhood perform the intricate figures carved on ancient friezes.

Colonies Become Associated States

Indo-China was long the richest part of the French Empire. But the rise of nationalism in Asia struck the colonial system. Today Indo-China consists of Viet Nam and the autonomous kingdoms of Laos and Cambodia. Viet Nam state consists of old Annam, Tonkin, and Cochin-China. Laos and Cambodia are ruled by native kings. A native chief of state governs Viet Nam. Indo-China has a voice in the French Union (*see* France). Much remains to be done to widen public education and to improve health conditions, especially in rural areas. A small university was established at Hanoi in 1917. It aims to train Annamese students for administrative work. There are also a number of missionary schools.

French Get Foothold in 17th Century

French interest in this region began as early as 1663, when missionaries pushed eastward to Cambodia. A treaty with Cochin-China in 1787 paved the way for conquest in the 19th century. Cambodia became a French protectorate in 1863, Tonkin and Annam in 1884, and Laos in 1893. Annexation of Cochin-China as a colony, begun in 1862, was complete in 1867. In the second World War after France fell in 1940, the French were forced to cede Indo-Chinese military bases to Japan. In 1941 Thailand invaded Indo-China and won about 25,000 square miles in Laos and Cambodia. Later in 1941 Japan occupied all Indo-China, and from there attacked Malaya and Burma in 1942.

FACTS ABOUT INDO-CHINA

Extent.—North to south, about 1,000 miles; east to west, about 575 miles. Area, about 284,000 square miles (including Viet Nam, 127,000 square miles). Population (1948 est.), 27,000,000 (includes Viet Nam, 21,928,809; Cambodia, 3,748,000; and Laos, 1,200,000).

Climate.—Monsoon type. Annual precipitation on central coast, 100 inches. Temperatures: in dry season, south, 68°–80°F., north, 95° extreme; in wet season, south, 93° extreme, north, 43°–75°F.

Cities.—Saigon (with suburb Cholon, 1,179,000); Hué (with suburbs, 407,000); Hanoi, (237,150); Haiphong (143,000); Pnom-Penh (110,600); Binhdinh (1936 census, 75,000.)

Viet Nam Established

During the war the Annamese began to want freedom from France. After the war's end in 1945, Annam and Tonkin formed the republic of Viet Nam. France recognized their virtual independence in 1946 within the Indo-Chinese Federation and the French Union.

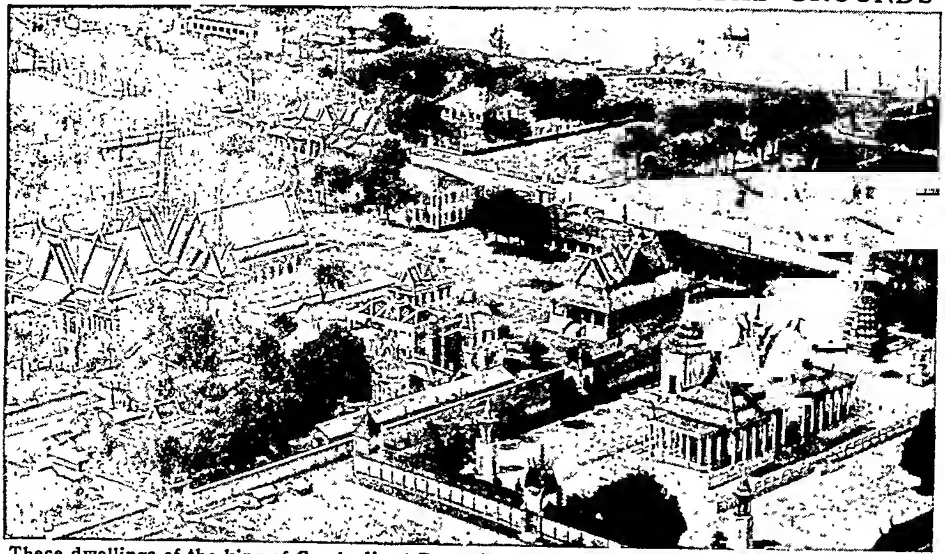
Ho Chi Minh, who had been trained in Communism in Russia, became president of the new republic. He demanded that Cochin-China join Communist-dominated Viet Nam. But Cochin-China is strategically important to the French and is the chief source of food for Indo-China. When France refused to give up Cochin-China, Viet Nam launched a bitter civil war.

The Vietnamese soon controlled most of the interior, while the French held only major cities, roads,

A TONKINESE STYLE IN HATS

This broad, flat hat of cunningly worked palm leaves is shaped for keeping off sun and rain, and yet is light to wear.

TEMPLES AND PALACES OF CAMBODIA'S ROYAL GROUNDS



These dwellings of the king of Cambodia at Pnom-Penh are modern. But the sculptured towers and tiered roofs recall the ornate style of the ancient Khmers. In the distance lies the Mekong River.

and plantations. The cost of the colonial warfare added to France's inflation at home.

In 1948 France recognized the independence of Viet Nam, providing that it accept Bao Dai, former emperor of Annam, as chief of state. Ho Chi Minh at once set up an opposition government. His Vietminh forces launched guerrilla warfare against Viet Nam.

France in 1949 let Cochin-China unite with Viet Nam. The French also established Laos and Cambodia as associated states in the French Union. To keep Communist forces from engulfing Indo-China and all Southeast Asia, the French sent Indo-Chinese and Legion troops against the Vietminh. The French got American economic aid and arms. The Vietminh won control of most of the interior. Finally a truce was signed in July 1954. The Vietminh gain was 77,000 square miles of territory, including the major cities of Hanoi and Haiphong, and 12 million people. Viet Nam kept 50,000 square miles, including the capital city, Saigon, and 11 million people.

INDONESIA, REPUBLIC OF. After striving nearly half a century for freedom the islands of the Netherlands Indies became an independent nation in 1949. The new nation first called itself the United States of Indonesia. In 1950 it became the Republic of Indonesia. The republic embraced all the islands of the former Dutch colony, except New Guinea. So ended the 350-year rule of the Netherlands over the immensely rich and strategic East Indies.

FACTS ABOUT REPUBLIC OF INDONESIA

Extent.—Length, about 3,000 miles; width, about 1,200 miles. Land area, about 579,000 square miles. Population (1950 est.), 79,260,000.
Natural Features.—Chiefly rolling hills, mountains, and marshes. Great ridge from Sumatra to Timor, north through Celebes; rises abruptly from Indian Ocean, but plains on north side. Over 100 volcanoes. Highest mountain, Koerintji (Sumatra), 12,484 feet. Largest lake, Toba (Sumatra), about 500 square miles.
Cities (1950 est.).—Jakarta, Java (formerly Batavia, capital), 2,800,000; Soerabaja, Java (800,000); Bandoeng, Java (750,000); Soerakarta, Java (500,000); Djokjakarta, Java (500,000); Medan, Sumatra (500,000); Makassar, Celebes (400,000); Palembang, Sumatra (350,000); Semarang, Java (307,000).

The Republic of Indonesia is a vast arc of some 3,000 islands strung along the equator from southeast Asia, between the Pacific and Indian Oceans, to Australia. The map in the article East Indies suggests how the islands would stretch across the United States of America. The land area of Indonesia is about 579,000 square miles—larger than California, Texas, and Montana combined.

On the island of Java live almost 60 per cent of Indonesia's population (*see* Java). The former Dutch part of Borneo is the largest land mass of Indonesia. The second largest is the island of Sumatra (*see* Sumatra). One of the major "crossroads" of Indonesia is Celebes Island (*see* Celebes). Other major islands include Madoera, Billiton, Bangka, and Riouw Archipelago. Other islands in the east are called "East Indonesia." They include Bali, Flores, former Dutch Timor, Celebes, and the Molucca Islands.

The geography of Indonesia, and how the people live, is told in the article East Indies. The history of the Indies as a Dutch colony is also told there.

The Government of Indonesia

The Republic of Indonesia is made up of ten provinces. These administer the thousands of islands. There are three provinces in Java, three in Sumatra, three in East Indonesia, and one in Borneo. A constitution adopted in 1950 called for a provisional one-house parliament. Executive powers rest in a president, vice-president, premier, and cabinet.

Indonesia's Path to Freedom

Indonesians, as people of the East Indies are called, fell under Dutch control late in the 16th century. On the whole, the Netherlands administered the colony with skill and with considerable concern for health and economic measures. But they kept control of the government firmly in their own hands. Indonesians made little effort to gain self-government until early in the 20th century. Then the rising tide of nationalism touched the Indies. After the first World War native demands for greater self-rule forced the Netherlands to make some concessions in local government.

War Speeds Revolt

The second World War brought a surge of nationalism. In 1942 the Japanese swiftly crushed the Dutch rule in the Indies (*see* World War, Second). They occupied the In-

dies for three and a half years, constantly trying to undermine trust in the Netherlands. Their propaganda promised autonomy to the Indies.

But during the occupation the Netherlands sought to maintain the loyalty of the Indies. In a radio address on Dec. 6, 1942, Queen Wilhelmina pledged that after the war the Indies would become a partner in a commonwealth with the mother country. The queen promised that the Indies would have complete freedom in internal affairs.

Most Indonesians remained loyal. But although the nationalists were in the minority, they were well organized. They were determined to proclaim the freedom of Indonesia. On Aug. 17, 1945—just two days after the collapse of Japan—the nationalists proclaimed the independent Republic of Indonesia. It consisted of Java, Sumatra, and Madoera.

Neither the Dutch nor the Allies recognized the new republic. British troops moved in to restore order. They clashed with the republican forces. Soon a state of war existed. Dutch troops replaced the British forces. The fighting increased.

Mediation and Broken Promises

Under a British mediator the Dutch and Indonesians made a truce. In 1946 they concluded an agreement at Linggadjati, near Cheribon in Java. The Dutch agreed to recognize the Republic of Indonesia. They also agreed to establish, by Jan. 1, 1949, the United States of Indonesia. This was to comprise three states—the Republic of Indonesia, Dutch Borneo, and East Indonesia. This United States of Indonesia was to join the Netherlands in a Netherlands-Indonesian Union, with the queen as symbolic head.

But negotiations to perfect the agreement failed. Dutch and Indonesians clashed often in armed conflict. Meanwhile, the Dutch stirred bitterness by dividing the Indies into several small states. Unrest spread until the Dutch in 1947 launched "police measures."

United Nations Intervenes

When the Dutch police policy became a full-scale military operation, the United Nations intervened. Terming the Indonesian conflict a threat to world peace, it issued a cease fire order and sent a committee to mediate. But fighting continued.

In 1948 the United Nations committee persuaded both sides to try compromise. Again negotiations failed. The Dutch claimed that the republicans were dominated by Communists and did not represent the people. Republicans asserted that the Dutch feared plebiscites, had set up "puppet states," and maintained a naval blockade against Indonesian commerce. The Dutch then renewed large-scale "police action."

The United Nations censured the Dutch for violating the truce. In 1949 the United Nations again gave a cease-fire order. The Dutch complied. At a conference in The Hague a provisional constitution was adopted for a United States of Indonesia.

On Dec. 27, 1949, the Netherlands Indies gained their freedom as the United States of Indonesia. The young nation had grave problems. It had to learn self-government, fight illiteracy, face the threat of Communism from China, and quell the Moslems, who wanted a Mohammedan state. To aid Indonesia, the United States and the Netherlands granted it loans.

In 1950 all the states of the USI united to form the Republic of Indonesia. Indonesia and the former mother country then formed the Netherlands-Indonesian Union. Though handicapped by inexperience, Indonesia began to build schools, housing, and roads. As a start toward taking over all mines, it nationalized tin mines in 1953. In 1954 it asked the Netherlands to discuss dissolving their Union.

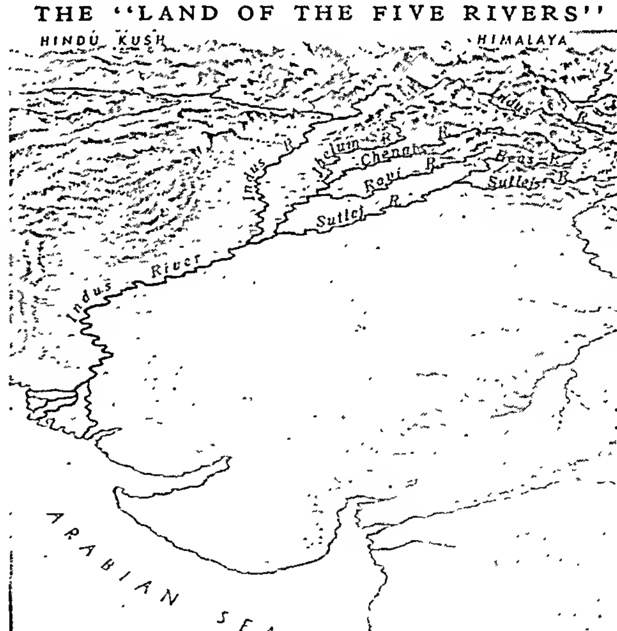
INDUS RIVER. One of the important centers in mankind's advance toward civilization has been the basin of the Indus River in the northwest portion of the Indian peninsula. Before 3000 B.C., when the Sumerians of Mesopotamia and the Egyptians were establishing a civilized way of living, equally great progress was being made along the Indus. In fact, many of the advances credited to the Sumerians may actually have originated in the Indian center.

The region is highly important also because of the discovery there of prehistoric animals in various stages of development. Many of the most important finds which show how the apes took shape through the ages have been made in the Siwalik Hills at the headwaters of the Sutlej, a tributary of the Indus.

Through the centuries that followed, the Indus Valley was a place of entry for conquerors of the Indian peninsula. Indo-European Aryans, Mohammedan Turks, and Mongols used it as a base. Today it shelters a strong Mohammedan population which took a leading part in carving the state of Pakistan from the older Indian territory.

The Indus River rises in the Himalayas in Tibet, and rushes through steep gorges for the

THE "LAND OF THE FIVE RIVERS"



This bird's-eye view shows the northwestern part of the Indian peninsula with the towering Himalayas in the distance. From them come the Indus River and its five tributaries. These rivers bring water for irrigation and other uses to the lower valley.

first 500 miles of its 2,000-mile course. It flows northwest across the Vale of Kashmir, then bends to the south and pours onto the hot, dry plain of the western Punjab in Pakistan. The name Punjab means "land of the five rivers." It refers to five rivers which flow into the Indus: the Jhelum, Chenab, Ravi, Beas, and Sutlej. Swollen by the waters of these tributaries the Indus crosses the Sind plain. It reaches the Indian Ocean through a delta 130 miles wide.

In the headwaters region, the Indus and its branches cut across the Himalayas, the highest mountains in the world. This happens because the rivers were established before the mountains arose. They kept their beds cut down as fast as the rocks were pushed up into mountains.

Like the Nile in Egypt, the Indus builds up and waters the lands along its lower course. Rainfall in the Sind averages only four inches a year. But the west monsoon winds bring torrents of rain on the Himalayas, and the water washes an immense amount of gravel and sand into the Indus and its branches. When the river slows down in its course it deposits this material. It also spreads soil far and wide during floods. The soil deposits have raised the river bed 70 feet above its ancient level. This increases the danger of floods. But it also helps engineers to draw off water for irrigation with dams and canals.

Before Great Britain gave up its Indian Empire in 1947, irrigation systems had been built to carry water to more than 36 million arid acres. The Lloyd Barrage (dam) at Sukkur on the Indus in Sind was one of the largest in the world, and an intricate network of canals watered the interstream areas, called *doabs*.

After partition the new nations pushed long-range plans for huge projects to reclaim many millions of acres of desert. The chief works built by Pakistan were also on the Indus, while India's new projects took water from the Sutlej and its tributaries.

An Early Cradle of Civilization

The Indus ranks with the Nile, the Tigris, and the Euphrates for nurturing one of the oldest civilizations on earth. Sir John Marshall and others have found remains of cities at Mohenjo-Daro near Karachi, and at other sites, which are as old as the early Sumerian cities in Mesopotamia. They are older than the Pyramids of Egypt. The excavations showed that these ancient cities had broad streets, fine brick buildings, and bathrooms in nearly every house.

How MACHINES *Changed Our* WAY OF LIVING

INDUSTRIAL REVOLUTION. Down through the ages men dreamed of wealth that should come by magic and not by work. For thousands of years nobody did much to make the dream come true. Today we have power-driven machines that create a host of products more wonderful than the writers of fairy tales could even imagine. How machines changed the world of yesterday into the world we know today is the story of the Industrial Revolution.

About the time of the American Revolution, the people of England began to use machines to make cloth and steam engines to run the machines. A little later they invented locomotives. Productivity began a spectacular climb. By 1850 most Englishmen were working in industrial towns, and Britain was the workshop of the world. From Britain the Industrial Revolution spread gradually throughout Europe and to America.

The most important of the changes that brought about the Industrial Revolution were: (1) the invention of machines to do the work of hand tools; (2) the use of steam, and later of other kinds of power, in place of the muscles of human beings and of animals; and (3) the adoption of the factory system.

Picture what the world would be like if the effects of the Industrial Revolution should be swept away. Electric lights would go out and our homes would be lighted by kerosene lamps or flickering candles. Automobiles and airplanes would vanish; so would railroads, power-driven ships, telephones, radios, and television. The children of the poor would have little or no schooling and would work from dawn to dark on the farm or in the home. Before machines were invented, work by children as well as adults was needed to provide enough food, clothing, and shelter for all.

As compared with political revolutions, the Industrial Revolution came about gradually. It happened in a short span of time, however, when measured against the centuries men had worked entirely by hand. Until John Kay invented the flying shuttle in 1733 and James Hargreaves his spinning jenny 30 years later, the making of yarn and the weaving of cloth had been much the same for thousands of years. By 1800 a host of new and faster processes were in use in both manufacture and transportation.

This relatively sudden change in man's way of life deserves to be called a revolution. It differs from a political revolution in its greater effects on the lives of people and in not coming to an end, as did the French Revolution or the American Revolution. Instead, the Industrial Revolution grew more powerful, year after year, as new inventions and manufacturing processes added to the efficiency of machines. Indeed, since 1914 the mechanization of industry has increased so enormously that another revolution in production is said to be taking place in our own time (*see* Industry, American).

The Industrial Revolution began in England about 1770 with the invention of textile machinery and the steam engine. Just why it came about then and there is explained by the conditions of industry and commerce at that time.

Industry on the Eve of the Revolution

Commerce and industry have always been closely related. Sometimes one is ahead and sometimes the other, but the one behind is always trying to catch up with the one ahead. Beginning about the year 1400, world commerce grew and changed so greatly that we sometimes use the term "Commercial Revolution" to

describe the economic developments of the next three and a half centuries. Many things helped to bring about this revolution in trade. The Crusades opened up the riches of the East to Western Europe. America was discovered and the European nations began to acquire rich colonies. New trade routes were discovered (*see* Trade). The strong central governments which replaced the feudal system began to protect and help their traders. Trading companies, such as the British East India Company, were chartered by governments (*see* East Indies). Larger ships were built and flourishing trade cities grew up.

With the expansion of trade, more money was needed, because large-scale trading could not be carried on by barter, as much of the earlier trade had been. Gold and silver from the New World helped to meet this need. Banks and credit systems developed. By the end of the 17th century Europe had a large accumulation of capital. And with the growth of capital, trade expanded still further, and new capital was available for new ventures. This had to happen before machinery and steam engines could come into wide use, because these devices are costly to manufacture and install.

By 1750 large quantities of goods were being exchanged among the European nations, and there was a demand for more goods than were being produced. England was the leading commercial nation, and the manufacture of cloth was England's leading industry. It was therefore natural that the new methods of making goods should have originated in England, and in the English textile industry.

ITALIAN CLOTH FACTORY—16TH CENTURY

Factories or central workshops like this existed long before the beginning of the Industrial Revolution, but they were few. The widespread adoption of the factory system, with machines run by mechanical power, was one of the most significant changes of the late 18th century.

How Production Was Organized

Several systems of producing goods had grown up by the time of the Industrial Revolution. In country districts families produced most of their food, their clothing, and the other articles they used, just as they had done for centuries back. In the cities merchandise was made in shops much like those of the medieval craftsmen, and manufacturing was strictly regulated by the guilds and by the government (*see* Guilds). However, the goods made in these shops, though of high quality, were limited in amount and costly. The merchants needed cheaper goods, as well as larger quantities, for their growing trade. So as early as the 15th century they had begun to go outside the cities, beyond the reach of the hampering regulations, and to establish another system of producing goods.

Putting-Out System

Cloth merchants, for instance, would buy raw wool from the sheep owners, have it spun into yarn by farmers' wives, and take it to country weavers to be made into cloth. These country weavers could weave the cloth more cheaply than city craftsmen could because they got part of their living from their gardens or small farms. From them the merchants would then collect the cloth, and give it out again to finishers and dyers. Thus they organized and controlled cloth making from start to finish. Similar methods of organizing and controlling the process of manufacture came to prevail in other industries, as, for example, making nails, cutlery, and leather goods.

Some writers call this the Putting-out System. Others call it the Domestic System, because the work was done in the home ("domestic" comes from the Latin word for home). Another term is Cottage Industry, because most of the workers belonged to the class of farm laborers known as cotters, and carried on the work in their cottages.

This system of industry, though it seems clumsy to

COTTAGE INDUSTRY IN 18TH-CENTURY ENGLAND

The production of woolen goods gives employment to all members of this English family. The mother and daughter spin and wind yarn while the father knits stockings on his stocking frame. (From an engraving in *Universal Magazine*, London, 1750.)

the workers of today, had several advantages over older systems. It gave the merchant a large supply of manufactured articles at a low price. It also enabled him to order the particular kinds of articles that he needed for his markets. It worked to the advantage of the craftsman too since it provided employment for every member of the family and also gave employment to craftsmen who had no capital to start businesses for themselves.

Infant Factories

A few merchants who had enough capital had gone a step further, bringing workers together under one roof and supplying them with spinning wheels and looms, or the implements of other trades, as well as with materials. These establishments were factories, though they bear slight resemblance to the factories of today. They were more like the enlarged shops of the craft guild masters.

Why the Industrial Revolution Began in England

To sum up, here are some of the reasons why the Industrial Revolution began in England instead of somewhere else and why it began at the particular time it did: English merchants were leaders in developing a commerce which cried out for more goods; the increase in trade had made it possible for merchants to accumulate capital to use in industry; and a cheaper system of production had grown up which was largely free from regulation.

In addition to these commercial advantages, there were new ideas in the air, especially in England, which aided the movement. One of these was the growing interest in scientific investigation and invention. Another was the doctrine of *laissez faire*, or letting business alone. This doctrine had been growing in favor throughout the 18th century. It was especially popular after the British economist Adam Smith argued powerfully for it in his great work 'The Wealth of Nations' (1776).

For centuries the craft guilds and the government had regulated commerce and industry down to the smallest detail. By the time the Industrial Revolution began, many Englishmen had come to believe that it was better to let business be regulated by the free play of supply and demand rather than by laws. So the English government for the most part kept its hands off and left business free to adopt the new

machines and the methods of production which were best suited to these machines.

Beginnings of the Industrial Revolution

The most important of the machines that ushered in the Industrial Revolution were invented during the last third of the 18th century. Earlier in the century, however, three inventions had been made which opened the way for the later machines. One was the crude, slow-moving steam engine built by Thomas Newcomen in 1705, which was used to pump water out of mines (for picture, *see* Watt). The second was Kay's flying shuttle (1733), which enabled one man to handle a wide loom more rapidly than two persons could operate it before. The third was a spinning frame for spinning cotton thread with rollers, first set up by Paul and Wyatt in 1741. Their machine was not commercially practical, but it is significant as the first step toward solving the problem of machine spinning. (*See* Spinning and Weaving.)

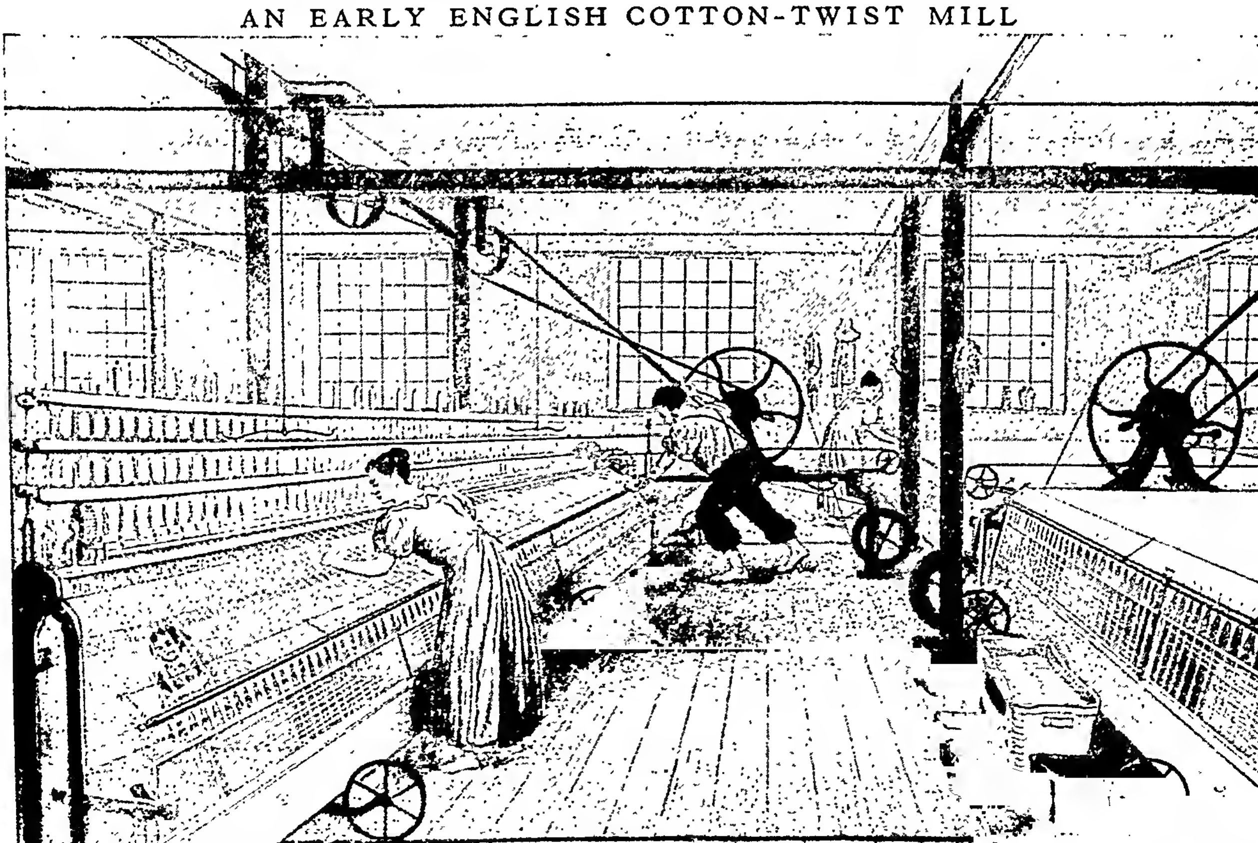
Inventions in English Textile Industry

As the flying shuttle speeded up weaving, the demand for cotton yarn increased. Many inventors set to work to improve the spinning wheel. Among them was a weaver who was also a carpenter, James Hargreaves. After working on his invention for several years, he patented his spinning jenny in 1770. This enabled one workman to run eight spindles instead of one. About the same time Richard Arkwright developed his water frame, a machine for spinning with rollers operated by water power. In 1779 Samuel Crompton, a spinner, combined Hargreaves' jenny and Arkwright's roller frame into a spinning machine, called a "mule." The mule produced thread of greater fineness and strength than either the jenny or the roller frame. Since the roller frame and the mule were large and heavy, it became the practice to install them in mills, where they could be run by water power and tended by women and children. (*See* Arkwright; Crompton; Hargreaves.)

These improvements in spinning machinery called for further improvements in weaving. In 1785 Edmund Cartwright patented a power loom. In spite of the need for it, weaving machinery came into use very slowly. First, many improvements had to be made before the loom was satisfactory. Second, the hand weavers violently opposed its use, because it threw many of them out of work, and those who got jobs in the factories were obliged to take the same pay as unskilled workers. So they rioted, smashed the machines, and tried to prevent their use. The power loom was only beginning to be widely used in the cotton industry by 1813, and it did not completely replace the hand loom in weaving cotton until 1850. It was still not well adapted to the weaving of some woolens and as late as 1880 many hand looms were still in commercial use for weaving woolen cloth. (*See* Cartwright.)

Many other machines contributed to the progress of the textile industry. In 1785 Thomas Bell of Glasgow

AN EARLY ENGLISH COTTON-TWIST MILL



These people are operating Crompton's "mule"—so named because it was a combination of two earlier machines, just as the mule is a hybrid animal. The mill stood in the hill country next to a swift stream, which furnished power to run the machines.

invented cylinder printing of cotton goods. This was a great improvement on block printing because it made successive impressions of a design "join up" and did the work more rapidly and more cheaply. In 1793 the available supply of cotton was increased by Eli Whitney's invention of the cotton gin (*see* Whitney, Eli). In 1804 J. M. Jacquard, a Frenchman, perfected a loom on which patterns might be woven in fabrics by mechanical means (for picture, *see* Rugs and Carpets). The Jacquard loom was afterward adapted to the manufacture of lace, and what had been the luxury of queens became available to everybody (*see* Lace).

Watt's Steam Engine

While textile machinery was developing, progress was being made in other directions. In 1763 James Watt, a Scottish mechanic, was asked to repair a model of a Newcomen steam engine. As he worked on it he saw how crude and inefficient it was, and by a series of improvements he made it a practical engine for running machinery. Wheels turned by running water had been the chief source of power for the early factories, and so factories were necessarily situated on swift-running streams. When the steam engine became efficient, it was possible to locate factories in more convenient places. Water power, however, continued to be used to a large extent because the use of the steam engine spread slowly. (*See* Steam Engine; Watt.)

Progress in Coal and Iron Production

The first users of steam engines were the coal and iron industries, which were destined to be basic industries in the new age of machinery. As early as 1720 many steam engines were in use. In coal mines, they pumped out the water which usually flooded the deep shafts. In the iron industry, they pumped water to create the draft in blast furnaces.

The iron industry benefited also from other early inventions of the 18th century. Iron was scarce and costly, and production was falling off because England's forests could not supply enough charcoal for smelting the ore. Ironmasters had long been experimenting with coal as a fuel for smelting. Finally a family of ironmasters, the Darbys, after three generations of effort, succeeded in using coal transformed into coke (*see* Coke). This created a new demand for coal and laid the foundation for the British coal industry. The next great step was taken in 1784 when Henry Cort and Peter Onions developed the process of puddling and rolling, which produced nearly pure malleable iron. (*See* Coal; Iron and Steel). Hand in hand with the adoption of the new inventions went the rapid development of the factory system of manufacture (*see* Factories).

Changing Conditions in England

It is easy to see how the new methods increased the amount of goods produced and decreased the cost. The spinner at a machine with 100 spindles on it could spin 100 threads of cotton more rapidly than 100 spinners could on the old spinning wheels. Southern planters in America were able to meet the increased demand for raw cotton to keep these spinners busy because they were using the cotton gin, which could do the work of 50 men in cleaning cotton. Similar improvements were being made in other lines of industry. British merchants no longer found it a problem to obtain enough goods to supply their markets. On the contrary, at times markets were glutted with more goods than could be sold. Then mills were closed and workers were thrown out of employment.

Progress in Transportation

With English factories calling for supplies, such as American cotton, from a distance and sending out goods to all parts of the world, better transportation was needed. The roads of England were wretchedly poor and often impassable. Pack horses and wagons crawled along them, carrying small loads. Such slow and inadequate transportation kept the cost of goods high. Here again the need produced the invention. Thomas Telford and John MacAdam each developed a method of road construction better than any that had been known since the ancient Romans built their famous roads. (*See* Roads and Streets.)

Many canals were dug, connecting the main rivers, and so furnishing a network of waterways for transporting coal and other heavy goods. A canal boat held much more than a wagon and moved smoothly if slowly over the water, with a single horse hitched to the towline. In some places, where it was impossible to dig canals and where heavy loads of coal had to be hauled, mine owners laid down wooden or iron rails. On these early railroads one horse could haul as much coal as 20 horses could on ordinary roads. (*See* Canals.)

Early in the 19th century George Stephenson's locomotive and Robert Fulton's steamboat, an American invention which England adopted, marked the beginning of modern transportation on land and sea. Railroads called for the production of more goods, for they put factory-made products within reach of many more people at prices they could afford to pay. (*See* Stephenson; Fulton; Locomotive; Railroads.)

Increase in Population and Growth of Cities

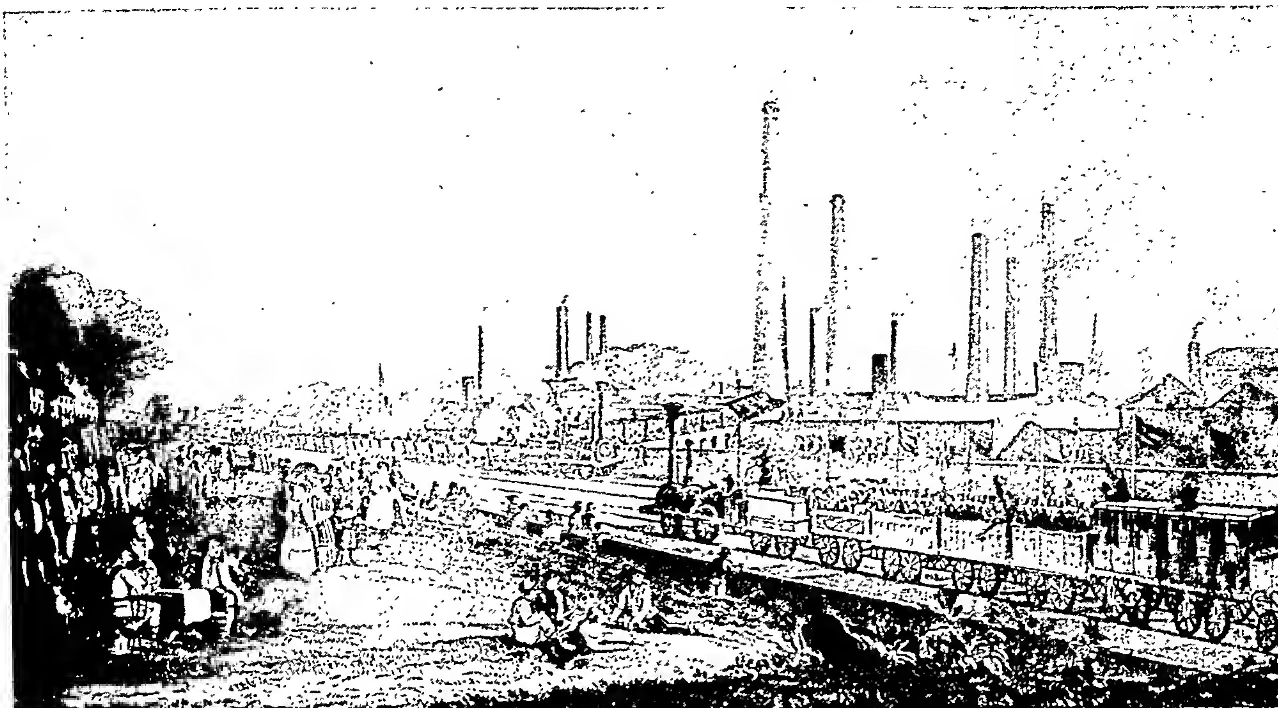
As conditions in industry changed, social and political conditions changed with them. Farm laborers and artisans flocked to the manufacturing centers and became industrial workers. Cities grew rapidly in population and the percentage of farmers in the total population declined. The population of England as a whole began to increase rapidly after the middle of the 18th century. Because of progress in medical knowledge and sanitation, fewer people died in infancy or childhood, and the average length of life increased.

The Condition of Labor

Far-reaching changes were gradually brought about in the life of the industrial workers. For one thing, machines took a great burden of hard work from the muscles of human beings. Some of the other changes, however, were not so welcome.

The change from domestic industry to the factory system meant a loss of independence to the workers. The home worker could work when he pleased. Though the need for money often drove him to work long hours he could vary the monotony by digging or planting his garden patch. When he became a factory worker he

GALA OPENING OF THE GLASGOW AND GARNKIRK RAILWAY



This view of St. Rollux, Scotland, in 1832, shows the type of factory landscape that began to appear in Britain when steam replaced water power. The early factories were set up along streams. With steam, they clustered around the coal districts.

not only had to work long hours, but he had to leave his little farm and live near the factory, often in a crowded tenement district. He also had to work continuously at the pace set by the machine. The long hours and the monotonous toil were a great hardship, especially for the women and children who soon became tenders of machines in the factories.

The change was particularly hard on the weavers and other skilled workers who sank to the position of factory workers. They had been independent masters, capitalists in a small way, and managers of their own businesses. They had pride in their skill. When they saw themselves being forced into factories to do other men's bidding for the pay of unskilled workers, it is no wonder that they rioted and broke up looms.

Problems of Capital and Labor

A man had to have considerable capital to buy machines and open a factory. Those who were successful made large profits with which to buy more machines, put up larger buildings, and purchase supplies in larger quantities at great savings. Thus capital increased far more rapidly than it ever had before. Much of it was invested in building canals, railroads, and steamships and in developing foreign trade. The men who controlled these various enterprises formed a new and powerful class in England—the industrial capitalists.

Both the capitalists and the industrial workers faced serious problems as the new order developed. The capitalists had a struggle to obtain a voice in the government. They needed a better system of banking, currency, and credit. They had to find markets for their products and hold them. They also had many difficulties in organizing their factories to run efficiently. And they had to make a profit on their investments in the face of intense competition.

Laissez faire (let it be) was the rule in England. This meant that the government had accepted the doctrine that it should keep hands off business. Factory owners could therefore arrange working conditions as they pleased. Grave problems arose for the workers—problems of working hours, wages, unemployment, accidents, employment of women and children, and housing conditions.

Children could tend most of the machines as well as older persons could, and they could be hired for less pay. Great numbers of them were worked 12 or 14 hours a day under terrible conditions. Many children were apprenticed to the factory owners and housed in miserable dormitories. Ill-fed and ill-clothed, they were sometimes driven to work under the lash of the overseer. The high death rate of these child slaves eventually roused Parliament to pass laws limiting the daily work for apprentices (*see* Child Labor Laws).

Workmen sought to win improved conditions and wages through labor unions. These unions often started as "friendly societies" which collected dues from workers and extended aid during illness or unemployment. Soon, however, they became organizations for winning improvements by collective bargaining and strikes (*see* Labor).

Industrial workers also sought to benefit themselves by political action. They became interested not only in fighting such laws as the English laws of 1799 and 1800 forbidding labor organizations but also in securing laws which would help them. The struggle by workers to win the right to vote and to extend their political power was a major factor in the spread of

democracy during the 19th century. (*See also* English History; Labor Parties.)

Revolution Spreads to the United States

Until 1815 France was so busy with the Napoleonic Wars that it had little opportunity to introduce machinery. When peace came, France began to follow England. It followed slowly, however, and has never devoted itself as exclusively to manufacturing as England has. Belgium was ahead of France in adopting the new methods. The other countries of Europe lagged far behind, making comparatively little progress until the second half of the 19th century.

The United States too was slow in adopting machine methods of manufacture. Farming and trading were its chief interests until the Civil War. The new nation had little capital with which to buy the machinery and put up the buildings required; and such capital as existed was largely invested in shipping and commerce. Labor was scarce because men continued to push westward, clearing the forests and establishing themselves on the land. The huge areas of fertile land in the West opened to settlement after the Constitution was adopted gave added impetus to farming.

A start in manufacturing, however, was made in New England in 1790 by Samuel Slater. An employee of Arkwright's spinning mills, Slater came to the United States in 1789. He was hired by Moses Brown of Providence, R. I., to build a mill on the Pawtucket, or Seekonk, River. English laws forbade export of either the new machinery or plans for making it. Slater designed the machine from memory and built a mill which started operation in 1790. When the Napoleonic Wars and the War of 1812 upset commerce and made English products difficult to obtain, more American investors began to look to manufacturing instead of shipping, and more factories were built.

New England, with its swift streams for power and its humid climate, which kept cotton and wool fibers in fine condition for spinning and weaving, soon developed an important textile industry. In Pennsylvania, iron for machines and tools and guns was smelted in stone furnaces with charcoal, which was plentiful in this forested land. Spinning machines driven by steam were operating in New York by 1810, and the first practical power loom was installed at Waltham, Mass., in 1814, by Francis Cabot Lowell.

Agriculture, fishing, and mining continued to be so profitable that comparatively few people were willing to invest money in industries. But some inventions besides farm machinery were made. One of the most important, because it greatly affected the daily life of all the women of the country and revolutionized the clothing industry, was the invention of Elias Howe's sewing machine (*see* Howe; Sewing Machine). During the American Civil War large factories equipped with the new machines were established for the manufacture of soldiers' uniforms. When peace came, these factories turned to making men's suits. It was during the Civil War also that the revolutionary idea of interchangeable parts was applied to the production of rifles (*see* Industry, American).

The Age of Steel

The period from 1860 to 1914 may properly be called the Age of Steel. During this period the manufacture of steel became a major industry. Several inventions and discoveries were responsible. The outstanding one was Henry Bessemer's process of steelmaking (*see* Iron and Steel). Many of the improvements in industry and transportation which came so rapidly in this period were made possible only by the production of steel in great quantities at low cost.

The Steel Age saw new materials come into use. Petroleum, with its many valuable products, reached quantity production in this period (*see* Petroleum). One of its products, gasoline, became increasingly important as a fuel after the invention of a new means of transportation—the automobile. With the process of vulcanizing rubber already discovered by Charles Goodyear (1839), cultivation of the rubber tree in the Far East got well under way just in time to furnish rubber tires for the new automobiles. Rubber found an untold number of other important uses (*see* Rubber).

Building on the work of such men as Benjamin Franklin, Michael Faraday, Thomas Edison, and others gave the world electric lights and countless electrical contrivances to make work easier. Finally the great electric power industry developed, bringing about great fundamental changes. (*See* Electric Light and Power; Franklin; Faraday; Edison.)

After 1914 a new revolution in production occurred in the United States, which led all other countries in the mechanization of industry and the development of new techniques for large-scale industrial organization. (*See* Industry, American; *see also* United States History, sections "Industrial America, 1877–1897" and "The Control of Industry, 1897–1915.")

REFERENCE-OUTLINE FOR STUDY OF THE INDUSTRIAL REVOLUTION

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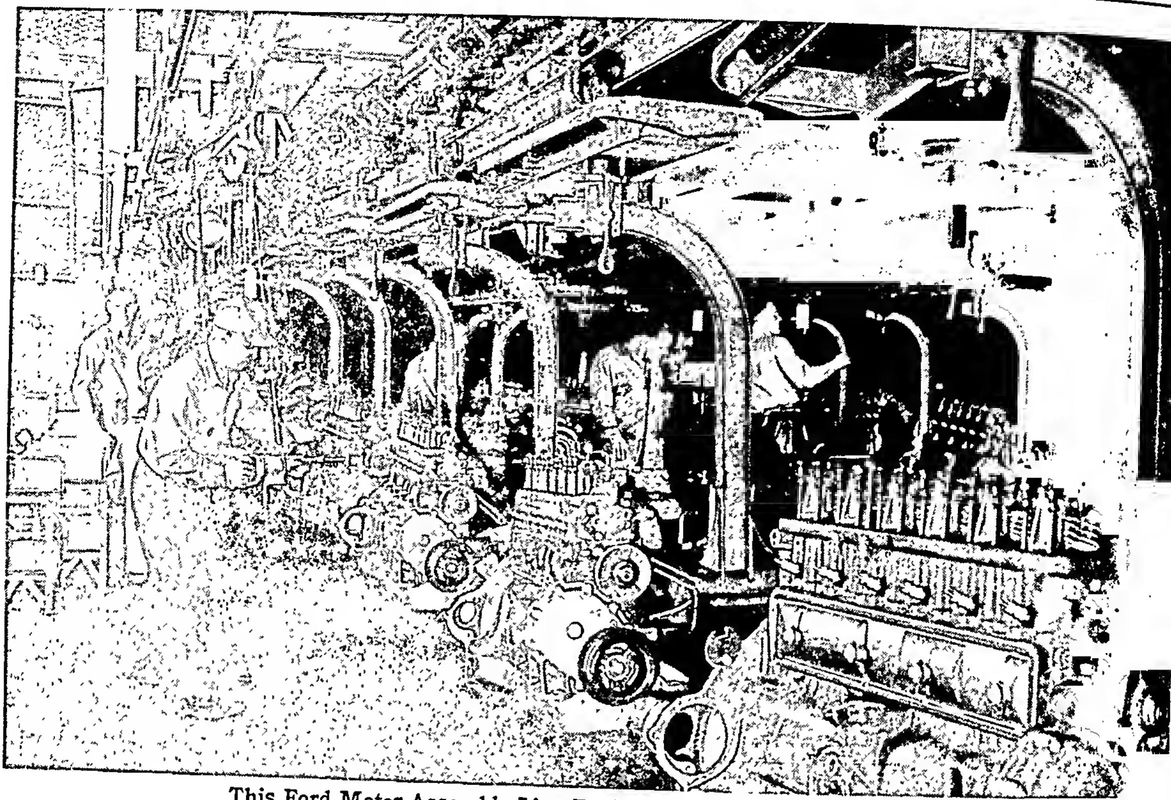
BIBLIOGRAPHY FOR INDUSTRIAL REVOLUTION

Books for Younger Readers

Bachman, F. P. Great Inventors and Their Inventions (Amer. Book Co., 1946).
Hartman, Gertrude. Machines and the Men Who Made the World of Industry (Macmillan, 1947).
Shippen, K. B. Great Heritage (Viking, 1947).

Books for Advanced Students and Teachers

Austin, Aleine. Labor Story (Coward-McCann, 1949).
Bruce, A. W. Steam Locomotive in America (Norton, 1952).
Burlingame, Roger. Inventors behind the Inventor (Harcourt, 1947).
Burlingame, Roger. March of the Iron Men (Scribner, 1938).
Dietz, F. C. The Industrial Revolution (Holt, 1927).
Glover, J. G. and Cornell, W. B. eds. Development of American Industries (Prentice-Hall, 1951).
Heaton, Herbert. Economic History of Europe (Harper, 1948).
Larsen, Egon. Men Who Changed the World (Roy, 1952).
Leyson, B. W. Modern Wonders and How They Work (Dutton, 1950).
Leyson, B. W. More Modern Wonders and How They Work (Dutton, 1952).
Popular Mechanics Magazine. Fifty Years of Popular Mechanics (Simon & Schuster, 1951).
Teague, W. D. Land of Plenty (Harcourt, 1947).



This Ford Motor Assembly Line Typifies American Industrial Know-How

AMERICA *at* WORK

INDUSTRY, AMERICAN. The United States is the most powerful industrial force in the world today. Moreover, it is going ahead at a faster pace than any other nation. If its rate of industrial progress is maintained, the standard of living of the American people could continue to double every 40 years or less.

The industrial system that has brought about this miracle of production began to emerge during World War I. The system is complex and its organization is unique. Politicians, historians, economists, and business analysts have all attempted to describe its development and to weigh its results. Their interpretations naturally vary widely according to their own particular backgrounds. There are, however, at least four basic points on which there is close agreement.

Points of Agreement about American Industry

1. American industry had its beginnings in England's Industrial Revolution. This so-called "revolution" began at about the time that the colonies were banding together for the Revolutionary War. America's revolution ended when the colonies were politically free. England's revolution in production, on the other hand, gathered momentum and set powerful forces in motion.

The Industrial Revolution was brought about by the inventions of a small group of ingenious men. New machines made factory production possible. To drive the machines, other machines were invented. For the first time in history mechanical power (other than water power) was substituted for the laborious work of man and his beasts of burden. From England, the Industrial Revolution spread gradually to other parts of the world. (*See* Industrial Revolution.)

The United States made a significant contribution to production methods at the time of another war, the American Civil War. A vast number of soldiers—by the standards of previous wars—had to be outfitted. Old methods of production were inadequate to equip such large armies. As a consequence, business and military leaders began for the first time to apply machinery on a significant scale to the production of uniforms, shoes, and rifles.

Up to this time rifle parts had been made by hand. Each part had to be fitted to the others in the particular gun being assembled. To fit each one of these parts into a gun required time-consuming hand-shaping operations. Moreover, because the parts were not expected to fit other rifles, there was no point in trying to carry stocks of repair parts at combat points. This meant that very few guns could be repaired in the field.

It was an entirely new idea that a rifle might be assembled from parts made in production lots on different machines. Machine-made interchangeable parts provided better, less expensive guns in large quantities. Furthermore, the field life of the gun was greatly prolonged because repair parts could be expected to fit. (*See* Whitney, Eli.)

2. Industry sets in motion a new revolution. The second point of agreement is that the industrial pro-

duction system of our own times reflects some new form of revolution. In the 20th century it became clear that the neat definitions of the Industrial Revolution no longer described current production methods. We date the start of this new revolution at about the time of the outbreak of World War I (1914). Actually such phases in the lives of men do not begin at an exact date nor do they cease at an exact date, as so many of our writings imply. The year 1914 is merely a convenient point to mark the beginning of a major change that cannot be precisely indicated by a sharp boundary of time.

To this new revolution many names have been applied. It has been called the period of mass production, of technocracy, of large-scale operations, of professional managers, of absentee owners, the age of new materials, the age of electricity, the era of the industrial scientists, and, more recently, the age of the atom. Actually the revolution has been so far-reaching that no single term can describe it. It rests, in fact, on all these forces and also on the American educational system, which trains alert and skillful citizens. Throughout the world, Americans are famous for their know-how. (*See* Education; Vocations.)

This revolution has extended into so many reaches that it is likely future writers will identify still another revolution that is either about to occur or possibly has already started. For want of a better term, it may be called the *synthetic intelligence revolution*. In the Industrial Revolution, man's muscles were relieved of the fatigue of hard labor through the substitution of power machines. The new revolution is expected to relieve man's brain of the monotony of humdrum work through the substitution of electronic intelligence machines. Fantastic electronic machines are in use today. They operate around the clock and show no sign of fatigue. They compute millions of times faster than man's brain and with a degree of accuracy that man cannot equal. (*See* Calculating Machines.) As the "synthetic intelligence revolution" goes on, the machines will perform low-grade thinking functions that will free man to concentrate his thinking efforts at higher levels than his electronic servants.

3. American industry reaches into world affairs. The third point of agreement is that the revolution in production has been largely concentrated in the United States and that many of the innovations growing out of it are spreading from this country to others. The spread has been quickened by students who come from abroad to attend American engineering, technical, and business schools in order that they might take back to their own countries American industrial knowledge, commonly called know-how.

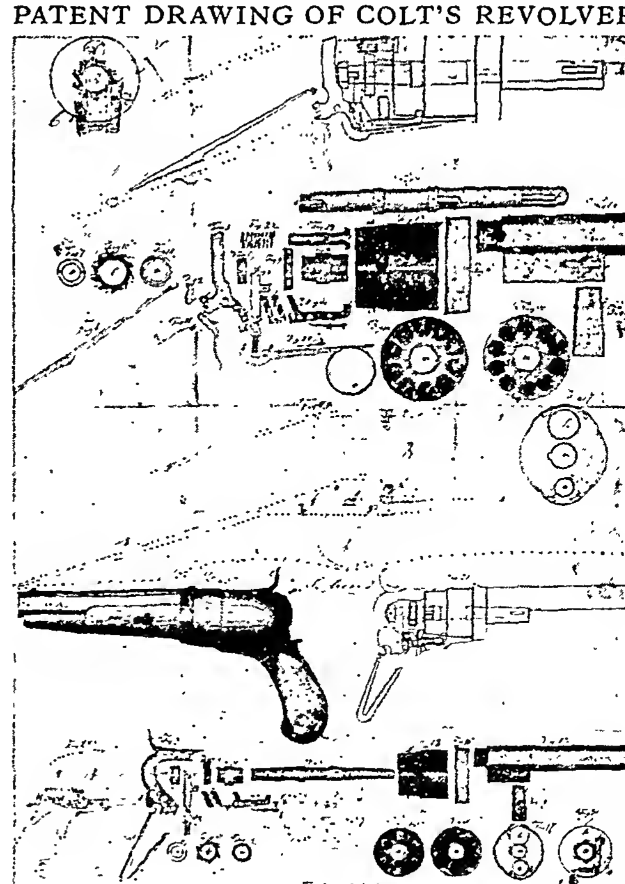
It is generally recognized that in World War II American losses were increased because Japan and Germany used skills and industrial knowledge that had been learned from America. Russia also benefited greatly from the period of scholarly freedom that followed World War I.

After World War II, America's national policy was directed toward making friendly nations stronger by the dissemination of industrial knowledge. Task force teams of business leaders were organized to explain to America's allies the principles and methods through which the revolution of production had come about. Moreover, the United States government even provided funds with which friendly nations might acquire from America machines and tools so that these nations might increase their own production and wealth.

4. American industry is dependent upon the enterprise system. On the fourth point there is general agreement but also some disagreement. This relates to a basic principle of the American system which justifies its results being called a "revolution."

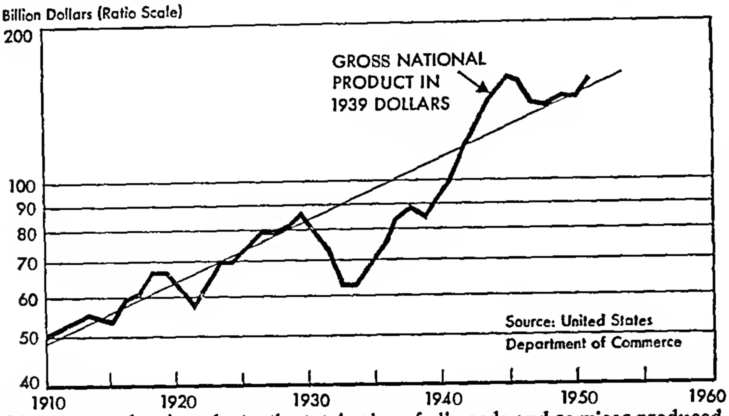
Economists, politicians, businessmen, labor leaders, and government officials would probably all agree that, for good or bad, the American industrial system may be summed up as *the production, for private profit, of more and more goods at lower costs and the increased distribution of these goods at lower prices*. This is the principle. It does not follow that all businesses practice it at all times and cut their prices immediately when they cut their costs. Nevertheless businesses that succeed over a long period of time do so by remaining competitive, and competition means operating under this principle. Businessmen who operate solely for maximum profit follow the principle as closely as those who are more social minded.

PATENT DRAWING OF COLT'S REVOLVER



The American system of production, based on interchangeable parts, was used early at Samuel Colt's arms factory in Hartford, Conn. This drawing secured for Colt his first patent, in 1836.

Since 1910, national output has grown about 3 per cent a year



The gross national product—the total value of all goods and services produced —measures the tremendous strength of the American economy.

Closely intertwined with the revolution in production is the American *enterprise*, or *initiative*, system. Unfortunately this system has never been fully understood even by professional economists. Those who try to describe it must employ words that mean different things to different people and groups. Some of these words are capitalism, materialism, property rights, human rights, free enterprise, and exploitation. These words carry emotional connotations and involve deep-seated social and political biases as well as ethical concepts. As a consequence, no one has been able to define satisfactorily the enterprise system that is basic to the revolution of production in the United States.

In spite of this difficulty, it is necessary to have some understanding of the enterprise system if one is to comprehend the industrial system of our times. The following statement, on which there is reasonable agreement, has been framed to help provide a basic understanding:

Our nation's laws honor the rights of the individual, private property, patents, and the maintenance of competition. The people's moral beliefs honor the dignity of man as well as the dignity of work. Under these laws and moral beliefs, the people, being practical and fair-minded, have traditionally allowed the individual who strove to get ahead "under his own steam" to be rewarded for his efforts and successes.

When James B. Conant was president of Harvard University, he described our enterprise system as one of "social mobility." This means that an individual may move from one stratum to another depending upon his talents, his desires, and his discipline. In the selection of his goals and in the means of his personal expression he is relatively unrestricted. (*See* Individual Freedom.)

Industry's Contribution to Our Welfare

Over the years our industrial system has produced tremendous wealth. At some times the economy has been more prosperous than at others. The varying conditions are often referred to as "good times" and "bad times." The economists call these shifts *cycles*. In spite of occasional "bad times," our economy on the whole has been highly prosperous—by far the most prosperous that the world has ever known.

There are various ways of measuring the efficiency of our industrial system. One measure is the *productivity of labor*. Frederick C. Mills of the National Bureau of Economic Research has studied productivity extensively. His work shows that output per man-hour of work increased about 20 per cent in each decade after 1910, except in the ten-year period of the 20's, when the increase was 35 per cent. This means that the efficiency of labor has been rising at the rate of about 2 per cent each year. Increases in output per man-hour are due largely to the increasing mechanization of industry.

Another measure of production gains is *gross national product*, abbreviated GNP. Under this term economists lump the goods, services, and related elements of national wealth produced each year. The ratio graph on this page shows the percentage increase over the years measured in constant 1939 dollars (*see* Graphs; Statistics). After allowance for the effects of inflation, the nation's output is found to have risen about 3 per cent a year since 1910.

Still another measure of industry's contribution to our welfare is the *real income* of people. In the 40-year period 1914–54, real income almost doubled. Prices of things changed constantly. *Real* income is the statistical measure of the purchasing power of income after corrections have been made for the changing value of the dollar. The value of the dollar went down in this period; but money income increased so fast that people greatly improved their standard of living none the less.

By these and other means American production is measured statistically. However, as individuals we are inclined to measure the results of production in things we can see and use. Such things as automobiles, telephones, and television sets contribute enormously to our pleasure and convenience. The pictorial chart on the next page shows that the people in the United States, who comprise only 6½ per cent of the world's population, own an enormous proportion of these manufactured items. The chart shows still another kind of production—social wealth. This is typified by churches, hospitals, schools, and libraries.

New Techniques of Organization

Contributions to the advancement of industry are no longer made solely by individuals. Today the organized activity of groups stands out in marked contrast to the period of the Industrial Revolution.

Each of the great inventions of the early period was linked to the name of an individual. Newcomen built a steam engine, and Franklin worked with electricity. Hargreaves invented the spinning jenny, and Whitney the cotton gin. McCormick built a reaper, Goodyear developed a vulcanizing process, Bell the telephone, and Bessemer a process for making steel.

In finance and commerce also it was individuals who saw the possibilities in these inventions and who risked capital to create businesses. For example, Moses Brown, of Providence, R. I., started the first textile mill in the United States by bringing Samuel Slater from the Arkwright Mills in England to build it. Francis Cabot Lowell and other New Englanders became well known for similar ventures. In other enterprises individual success was attained by Vanderbilt, Carnegie, Frick, Gould, Guggenheim, Rockefeller, Firestone, Mellon, and Morgan. Thomas Edison and Henry Ford became famous not only because of their inventive ability but also because they had the capacity to organize, promote, secure financing, and manage their own ventures, which prospered dramatically.

By 1914 business was becoming increasingly large and complex. It was no longer possible for one person to keep in touch with all the parts of a huge and fast expanding enterprise or to understand all the key facts concerning its operations. It became necessary to divide responsibilities into particular areas such as sales, finance, accounting, and manufacturing. Those who supervised these areas became so proficient that they were in fact specialists.

World War I stimulated a vast expansion of industry. For the first time, many industrial nations banded together to fight an enemy that was also highly industrialized. To work effectively under the pressure of war, the Allies found that it was necessary to organize their efforts carefully through division and subdivision of functions and responsibilities. They also discovered that with the forces of many nations operating in different parts of the world, new organizational concepts had to be pioneered to assure co-ordination and integration.

After the war American industries began rapidly to apply to their businesses the new organizational lessons learned. During the 1920's spectacular organizational accomplishments were made by many companies —particularly by American Telephone and Telegraph, Standard Oil of New Jersey, Du Pont, and General Electric.

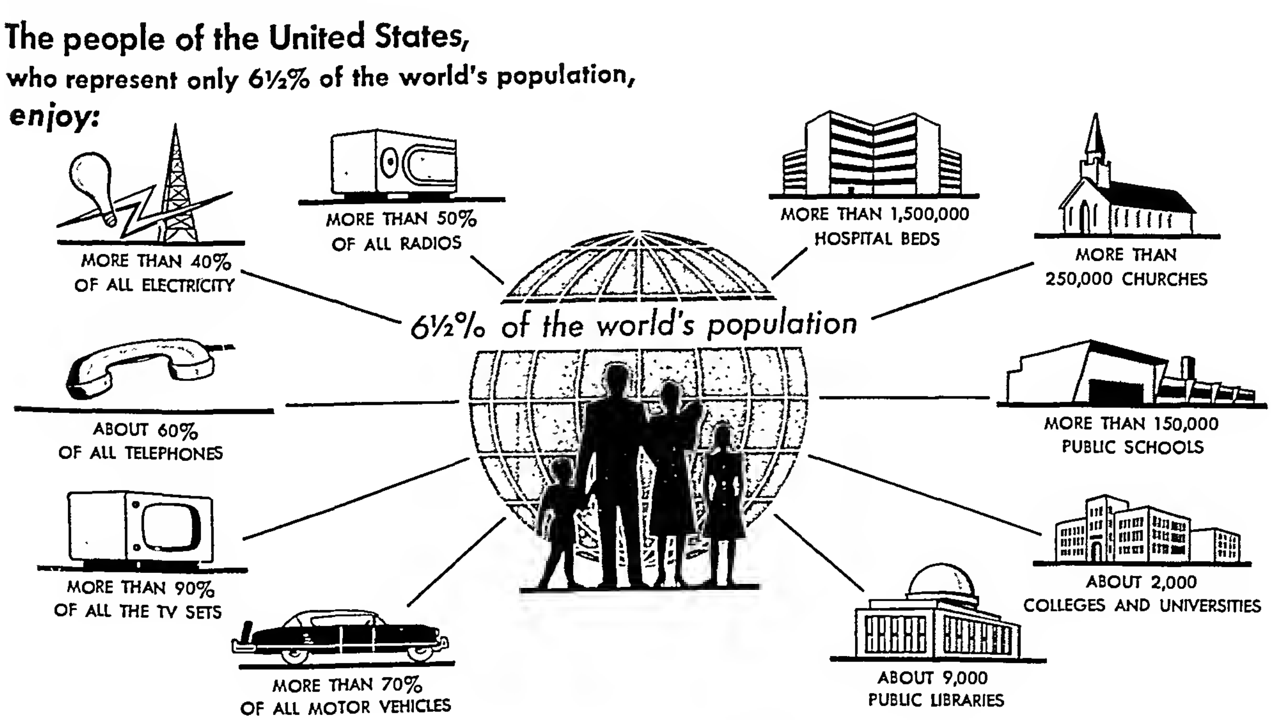
The Role of the Industrial Psychologist

In World War I it was found that psychology had many practical applications. Psychological tests were used to choose men for particular tasks. Large numbers of both soldiers and civilians were studied for their reactions under stress and pressure. From that time industrial psychology began to gain stature as a science.

The industrial psychologist is a professional specialist who assists management in selecting, training, and caring for workers. Many jobs have become monotonous because of the increased subdivision of labor. Hence it is important to relate workers to jobs according to their ability to tolerate monotony as well as according to their skills.

Industrial psychologists are interested also in finding out how people respond and work together in groups. A worker's motivation to perform satisfactory work is complex. Quite apart from the opportunity to increase his earnings and apart from his like or dislike of the supervision provided, it was discovered that an employee may be motivated by many other influences in his industrial environment. For example, being a member of a group and having a "sense of belonging" is a key force. (*See* Psychology.)

Today industry is giving increasing recognition to the role of the individual in a group and to the understanding of human relations. This is taking place at the very time when industry is making the job of the



AMERICA'S BILLION-DOLLAR CLUB

ASSETS IN MILLIONS OF DOLLARS

	1953	1939
Bell Telephone System..........	$11,973	$3,286
Standard Oil Co. (N. J.)........	5,372	2,035
General Motors Corp...........	4,405	1,323
U. S. Steel Corp...............	3,247	1,769
Pennsylvania R. R..............	2,505	2,037
Socony-Vacuum Oil Co..........	2,154	925
Standard Oil Co. (Ind.).........	2,036	723
New York Central R. R.........	1,992	1,631
Southern Pacific System.........	1,982	1,698
E. I. du Pont de Nemours & Co..	1,846	736
Texas Co......................	1,805	661
Bethlehem Steel Corp...........	1,783	733
Gulf Oil Co....................	1,766	523
Ford Motor Co.................	1,757	692
General Electric Co............	1,697	392
Pacific Gas & Electric Co........	1,620	657
Standard Oil Co. (Calif.)........	1,535	625
Consolidated Edison Co. (N. Y.).	1,509	1,023
Atchison, Topeka & Santa Fe Ry.	1,499	1,116
Sears, Roebuck & Co............	1,388	324
Union Pacific R. R..............	1,346	1,101
Baltimore & Ohio R. R..........	1,309	1,110
Westinghouse Electric Corp......	1,265	217
Union Carbide & Carbon Co.....	1,191	337
Humble Oil Co.................	1,186	375
Commonwealth Edison Co.......	1,167	717
Sinclair Oil Co.................	1,141	353
Cities Service Co..............	1,103	*
Phillips Petroleum Co...........	1,039	223

*No comparable figures available for 1939.

Comparison of the two columns of figures shows the phenomenal growth of America's largest corporations since 1939.

individual a fractionated part of a specialized group who together perform only one small factory operation. Specialization of effort has spread even to offices because mass production of paper work must keep up with the mass output of goods by the factory. This requires job fractionalization in offices and an assembly line technique. Management finds small jobs easier to teach the employee, easier to change, and easier to administer.

America's Giant Corporations

There are some 4 million business enterprises in the United States. Most of them are small establishments that are owned and run by one person or by two or more persons in partnership. These small businesses usually distribute merchandise or provide services. About 550,000 of them are organized as corporations. Most of the corporations also are small and the amount of business they transact is small.

The striking fact is that about a fifth of the goods manufactured is produced by about 50 of the largest corporations. A few of these have grown in size to exceed a billion dollars in plants, cash, and related assets. As the table shows, in 1953 there were 29 such giants. The American Telephone and Telegraph Company (Bell System), at the top of the list, was owned jointly by more than a million stockholders.

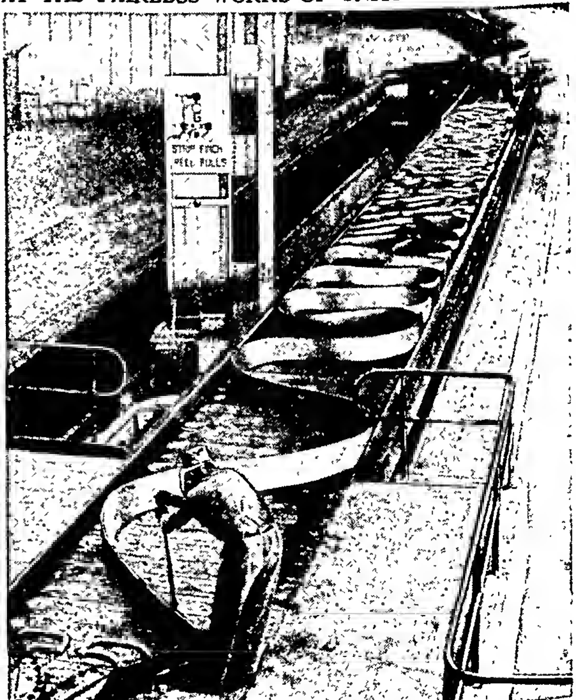
The Reasons for Large-Scale Operations

The automobile industry best illustrates why some companies have grown to billion-dollar giants. Years ago Henry Ford discovered that the more cars he manufactured, the cheaper he could sell them. The cheaper he sold them, the more people there were who could afford to buy them. To keep up with increased sales, production was stepped up. Larger production permitted further reductions of both costs and prices. This chain of relationships made the Ford Motor Company grow larger and larger.

As the company grew, the management learned how to do things better. This increased efficiency came about largely through the contributions of various specialists. Some engineers, for example, gave their full time to design. Others became expert in planning machinery or assembly lines to produce cars faster and cheaper. Material specialists sought out the best and cheapest raw materials. The industrial engineering group studied manufacturing operations. Time- and motion-study groups analyzed the various operations of workers to cut out unnecessary motions. These examples of specialization of effort were multiplied many times throughout industry. The result was quantity production, which came to be popularly known as *mass production*.

Mass distribution was needed to move the huge output of mass production to consumers. The Ford Motor Company appointed thousands of dealers over the country. Special schools were established to show the dealers how best to sell and, even more important, how to service the cars. A large field sales organization kept in touch with the dealers and helped them to solve their local problems. Specialized sales managers directed the field sales organization.

AT THE FAIRLESS WORKS OF UNITED STATES STEEL



Ribbonlike skelp, used in producing continuous weld pipe, leaves the rolling mill at speeds up to 1,200 feet per minute.

Advertising also became a specialty. Mass communication methods, national and local, were used to spread knowledge of the product and to promote sales.

In a related field, specialists became skilled in marketing research. Their function was to open up new markets by figuring out what consumers needed and would buy. Farmers were already using cars instead of horses for trips to town. Marketing research showed they were eager to buy trucks and tractors as well. Ideas for new conveniences also were turned over to the marketing research experts. Only after the market was known did automobile companies turn to automatic transmissions, power brakes, power steering, and semiautomatic dimming lights.

Finance had to keep pace with mass production and mass distribution. Financial specialists decided how much money was needed for each of the various processes of manufacture, for new machine tools, and for improving assembly lines, which are subject to frequent costly changes. They also had to make judgments about the vast sums needed for advertising and sales promotion to accomplish mass distribution. This work is called *financial planning*.

The purpose of machine tools is to hold the material and to make the cuts and shapes required for particular parts (*see* Tools). Many of the parts change with each new model. For each new part, new tools, specially designed and constructed, must be purchased.

Before World War II, most automobile manufacturers tooled each year for a new model. From the sale price of each of the many thousands of cars sold, a small sum was recovered for retooling costs. This made it economically possible for [illegible] for the next year.

Tools are constantly being improved and have become larger, more complex, and more expensive. Tooling costs for a new model after the war often approached 50 million dollars—a sum that could not be recovered from sales in a single year. Scrapping such expensive tools before they were worn out was uneconomical. As a result, automobile companies began to schedule major model changes for every three years. In the years between, a so-called "face lifting" took place that called for relatively minor design changes and inexpensive changes in the tools.

The broad financial plan is based upon records of expenses of manufacturing and distribution in previous years. On the basis of this over-all plan, the financial specialists draw up detailed plans for spending, called *budgets*. During the spending period, the various items of cost are compared with the budget figures, and each activity that exceeds its budget allowance is closely reviewed to get the situation in control again. This procedure is called *budgetary control*. Budgetary control is exerted in other ways too. For example, some activities may cost less than the budget allowances. These are studied to learn the reasons for their lower costs so that the lessons may be transferred to other activities of the business.

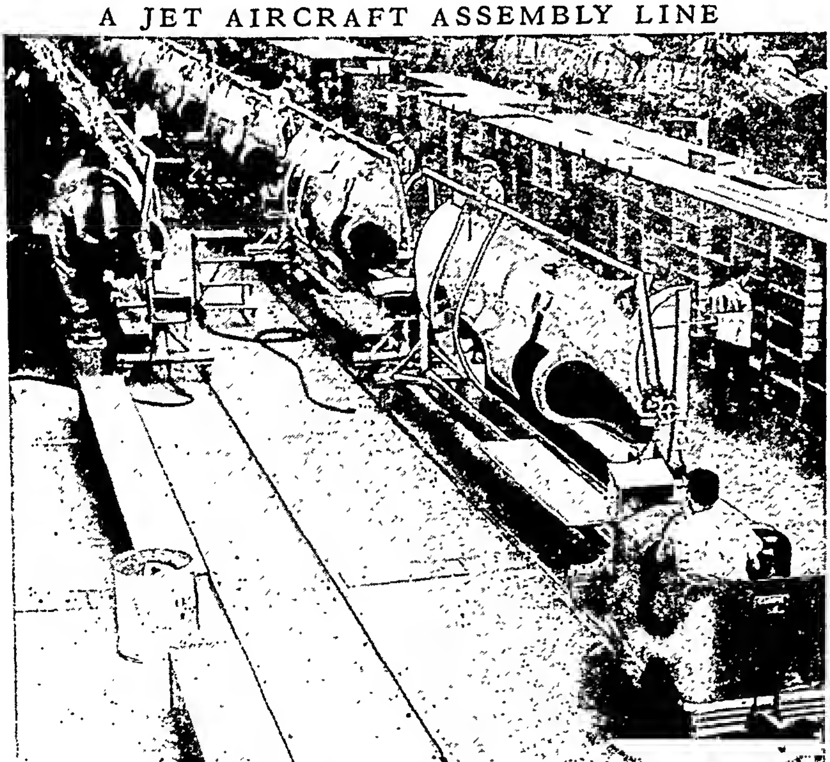
The financial specialists also help to raise funds to buy new plant capacity and other facilities needed by an expanding business. Outside money may be required too to meet the stepped-up demands of mass distribution. The funds may be obtained by increasing capitalization through the sale of more stock or by borrowing money for a period of time by selling bonds or making bank loans. (*See* Stocks and Bonds.)

The foregoing covers only key functioning areas. Specialization of effort and improved performance have developed in many other areas also. Examples are found in industrial research, patents and royalties, statistical forecasting, personnel counseling, labor negotiations, quality control, materials handling, and operations research.

What took place in the automobile industry phase by phase took place in varying forms in other industries. Large-scale operation methods have been particularly noteworthy in electrical and electronic machinery, consumer appliances, steel, chemicals, and petroleum. The process is still going on. Moreover, new groups of specialists are being formed constantly to enable large operations to be conducted more effectively.

The executive's role has become so demanding that administration

A JET AIRCRAFT ASSEMBLY LINE

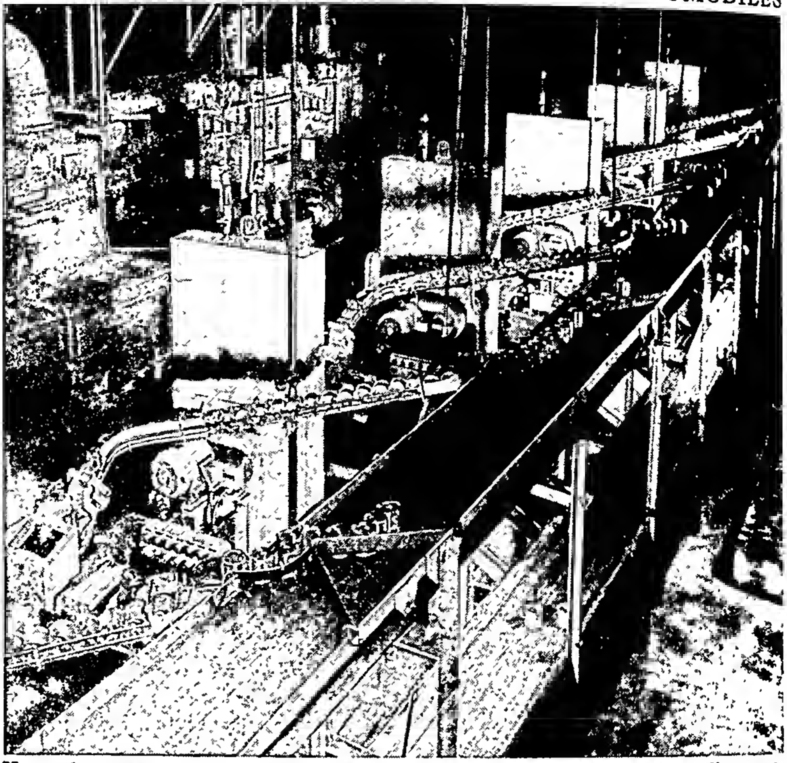


A small tractor pushes a long line of fuselages along a track, carrying work to the workers. When their operations are completed, the tractor hauls the fuselages away.

is rapidly emerging as a profession. To handle his job well, the executive must be specially trained in universities as well as on the job. Courses in business and research multiply the capacity and skill of an executive for leadership and organization.

Efficiency within a single manufacturing company would not result in large-scale operations without contributions from other industries. The tremendous increase in scientific knowledge has spurred invention in many fields. Collateral industries developed transportation and communication, supplied electric power, and devised better methods of constructing factory buildings. They improved machine tools and made regulating devices to control the tools. They furnished raw materials and even developed new materials, including synthetics.

MACHINING ALUMINUM PISTONS FOR AUTOMOBILES



No workmen are seen here because automatic controls—called "automation"—operate these machines. A belt conveyer system moves the pistons to the machines.

Some Details of Modern Production

Present-day mass production is so complex that it is difficult to see its beginnings in the early phases of the Industrial Revolution. Indeed, it bears only limited resemblance to the system of manufacturing that evolved later when the idea of interchangeability of parts was applied to the production of rifles. Nevertheless, despite the great changes that have taken place in manufacturing since the Civil War, the principle of interchangeable parts is still basic to all modern production.

Interchangeability of Parts. Interchangeability enables a manufacturer to produce large numbers of identical parts, any one of which may be used in assembling the finished products. Mass production justifies the investment in automatic machinery to produce the parts, thereby greatly reducing unit costs.

Engineering Design. Engineering specialists design the product and determine the parts from which it will be assembled. On engineering drawings they carefully specify the shapes and dimensions of the various parts and also indicate the amount of variation that can be tolerated (the tolerance).

Setting Tolerances. Tolerance is the amount of error or deviation permissible in the size of a part. Exceeding the limit of tolerance in either direction would mean that the part would have to be reworked or scrapped because it would not interchange or fit according to the design plan. Much thought therefore is given in the design plan to the setting of tolerances.

Wide tolerance limits in the parts are possible in some products. In other products very close, or narrow, tolerances are vital. Tolerances as narrow as four millionths of an inch are being employed in some of the highly engineered, electronically controlled navigation gear that directs a plane accurately over great distances. Maintaining this order of interchangeability for parts is extremely costly.

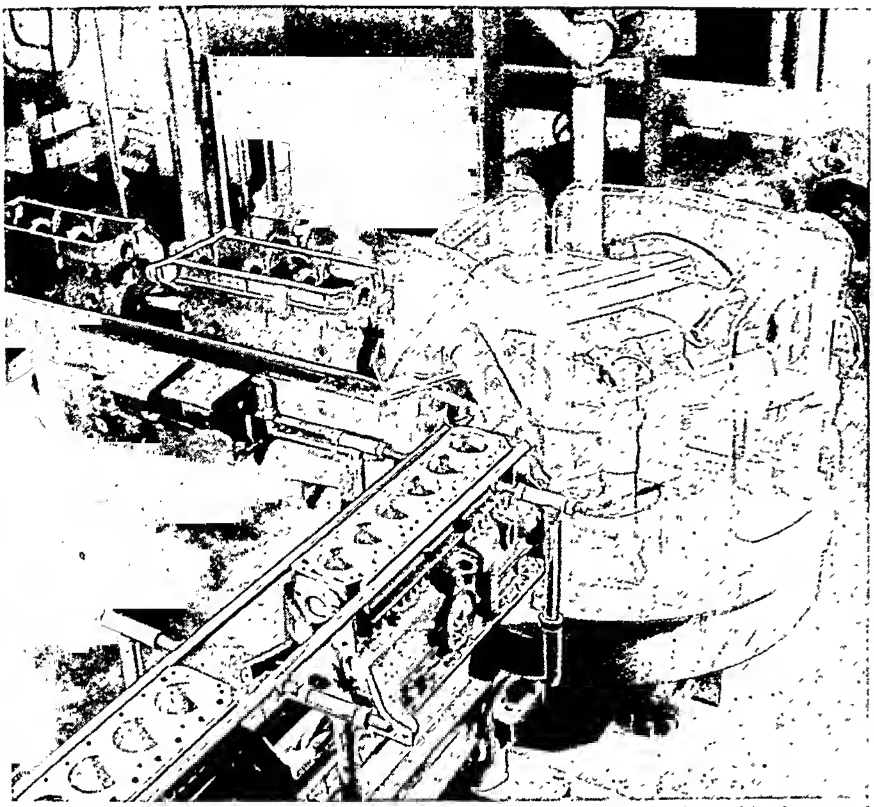
Machine Tools. To attain these close standards, machine tools of unusual accuracy have been developed. Automatic feeds, position shifts, and electronic controls have been applied to the machines to eliminate errors of man's hands and judgments.

New Raw Materials. Interchangeability of parts has made an impact in the field of raw materials also. The materials must be such that they can be machined to the required standards of accuracy. They must also hold their shapes and tolerances not only during manufacture but throughout the various conditions under which consumers use the product. To meet these needs, new raw materials have been developed.

New Cutting and Abrasive Materials. The cutting and shaping tools that form the parts have also benefited from the introduction of new materials. Tool steel must be hard if it is to cut hard materials. Moreover, it must possess high tensile strength so that it may be sharpened to fine edges to perform precision cutting.

In grinding and polishing operations the nature of the abrasive material influences the standards to which quality of interchangeability may be held. For this purpose, better cutting oils as well as liquids called *coolants* have been developed. These minimize wear and increase the speed of operations.

Precision Measurement. To verify the interchangeability of parts, precision gauges and other accurate



This completely automatic machine receives an engine block, turns it upside down and around, and sends it along the moving belt to be in position for the next operation.

measuring devices have been developed. Improvement has been made also in the inspection methods under which these accurate and often quite automatic measuring devices are employed.

Statistical Quality Control. It is expensive to handle, gauge, and examine each part at each manufacturing operation. By the application of statistical sampling methods, the number of parts individually inspected is reduced and labor costs are correspondingly lowered.

Under statistical quality control, sample production lots are segregated and identified throughout the various production operations. From these lots experience tables are compiled. Variations are carefully watched and the causes of differences are studied. When the cause and effect relationships that determine good or bad production are understood, it becomes possible to focus on those things that favor good production.

Productivity Standards. The forces of competition outside the industrial establishment operate within it to drive down the costs of manufacturing. To this end the efforts of many groups of specialists are directed. These groups include experts in industrial engineering, motion study and time study, operations analysis, quality control, scrap and rework, and cost accounting.

The experts direct their efforts primarily to setting, checking, and revising various standards against which the productivity of the different operations can be measured. In addition, they study ways to simplify and make easier each of the various labor operations in order to minimize unproductive motions and efforts.

cost records are compiled showing actual performance. It is the job of the foreman and other supervisors to check the day's performance score against the par, or standard. Where a bad score indicates below par performance, it is their job to determine the causes and correct the process.

By these methods fractions of pennies are shaved off production costs. Because of the mass of production going through the plant each day, a fraction of a penny on a single part can amount to many dollars of savings in a year.

Production Planning and Control. Quality control and time standards make it possible for production control specialists to make effective production plans. Costs can be cut by producing large lots or long runs of parts that interchange. With good design work, some parts can be used for more than one model or even for a number of different products.

The planning group, after studying sales orders, decides the quantities needed for the common parts and schedules the production runs. Production runs are planned according to the running time available for the different machines in the various production centers. The scheduling of production runs is called *shop loading.* Its purpose is to give work to the machine available, or "open," and thus keep both men and machines working productively as much of the time as possible.

Inventory Control. For effective production planning there must be accurate current knowledge of the raw materials, parts, and semifinished goods that are on hand. Accurate knowledge of the various materials is necessary also for the purchasing specialists so that they may buy the required items at the proper time and in economical quantities.

These facts are provided by a system of record keeping called a *perpetual inventory,* or *book inventory.* All movements of materials into and out of the inventory are recorded. Periodically the records are verified by making a physical inspection or actual count of the material and items in the stockrooms and warehouses. This process is called taking *physical inventory.*

Waste and pilferage are controlled through the use of these records. The records are consulted also to compile material manufacturing costs.

Factory Layout. Specialists in factory layout seek to improve the direct and easy flow of work. The flow begins with the receiving, inspecting, and storing of material and passes through all the various manufacturing and assembly operations into the shipping department.

The specialists try to utilize space effectively in order to lower costs. At the same time they strive for layouts that will provide safety for the workers by the proper segregation of dangerous operations and by wide and unencumbered aisles.

Because manufacturing processes are being constantly changed and improved, the specialists design the layout for flexibility in the use of power, water, heat, light, and other services.

The Assembly Line. The chief purpose of the assembly line is to move work to the worker. Interchangeable parts or subassemblies are brought to him at a regular, predetermined speed and he must perform his operation before the line carries the work away to other workers for succeeding operations.

By moving the work to the worker, the job is made easier because the power of a conveyer, or some other mechanical arrangement, is substituted for his muscle. The assembly line technique also permits a very high degree of specialization by the worker because he is not required to learn or perform more than a few simple operations. This reduces the expense of training people, and it lessens the amount of supervision necessary to direct the worker's efforts.

Job fractionalization tends to make work monotonous. Many of the problems relating to job dissatisfaction and other labor difficulties have developed around the assembly line technique. The result is that management has a large job, entailing many challenges, which must be mastered in order that people may derive necessary satisfactions from factory work.

Employee Benefits

Despite the increased monotony caused by job fractionalization, the worker's lot has improved vastly since the introduction of mass production. Extreme physical effort is being eliminated from factory work. Hours are shorter and pay has substantially increased.

Over and above the weekly pay check, many workers get *fringe pay* benefits. These may include paid vacations and pay for holidays, profit-sharing payments, premium pay for working night shifts, week ends and holidays, sickness and accident benefits, clean-up time, and "portal-to-portal pay"—for the time spent traveling from the gates to the mine shaft or factory bench and preparing for work. Fringe benefits may include uniforms, safety clothes, lunches, and coffee.

Many insurance benefits have been provided. Most of these are based upon shared payments from the worker and his employer. The forms of insurance coverage include unemployment, retirement, and compensation for accidents on the job. In addition to the plans administered by the state and federal governments, some companies cover their workers with supplementary retirement plans and life insurance, as well as hospitalization under group insurance plans. (*See also* Social Security.)

Working conditions too have been steadily improving. Factories are being located in smaller towns and in suburban areas to enable employees to work and live under more pleasant conditions. Thus, while companies are becoming larger and larger, many of them are *decentralizing* operations by dividing their plants into smaller units and dispersing them over the country. Inside the factory, working environment has been improved by the use of color, modern lighting, air conditioning, and recreation areas.

The Growth of Labor Unions

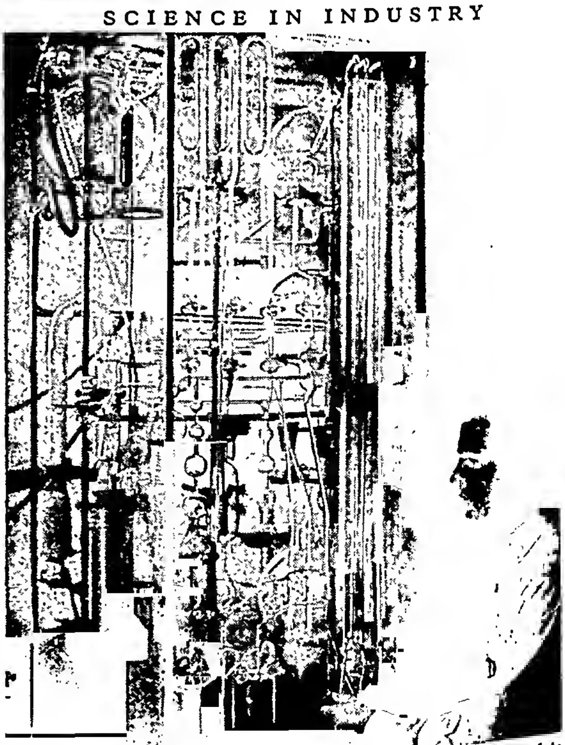
Mass production, by gathering many employees under one roof, gave rise to a striking growth of union membership and union influence. By the end of World War II, unionism had spread throughout most of the basic industries (except agriculture). Today unions are an organized political and economic force, with wide influence in the national scene. (*See* Labor.)

The large unions have raised and helped solve many problems in the relationships between workers and management and also between union and nonunion workers. The public at large has also been affected by the rise of unionism. On the whole the impact of unions has been beneficial, in varying degrees, to all groups of our industrial society.

The first objectives of unions are higher wage rates and shorter hours for their members. Unions have also made great advances in improving working conditions, in setting up grievance procedures, in establishing seniority rights, and in obtaining fringe benefits.

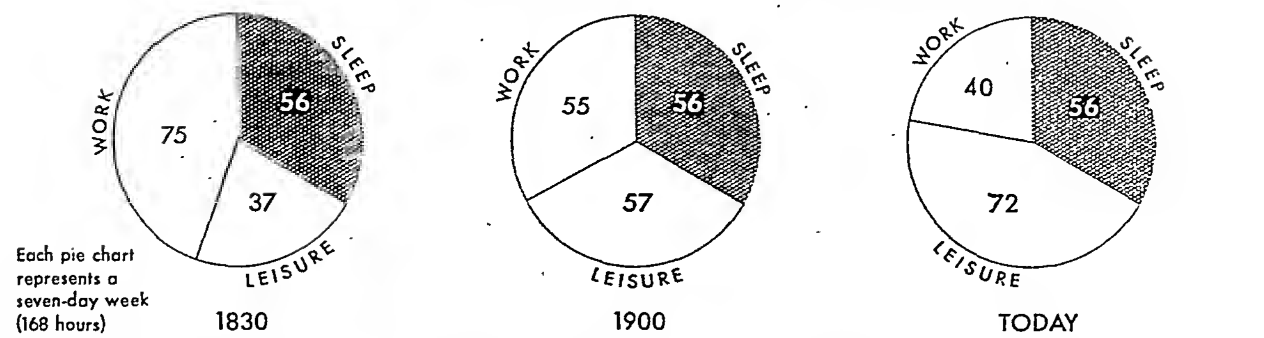
The job of the union leader is difficult. Unions compete with one another for membership; and within each union there are often ambitious "comers" who attempt to seize leadership by promising to obtain greater benefits. The leader therefore must constantly secure benefits from the employer by his representation of the union in collective bargaining

SCIENCE IN INDUSTRY



Studies made with this adsorption apparatus have helped to solve complicated problems in the processing of petroleum.

Hours of work and leisure per week in manufacturing industries



The American factory worker today not only has innumerable new things to enjoy but an ever-increasing amount of leisure time in which to enjoy them. Both benefits have been made possible by the marvelous tools technology has given the worker.

sessions. If he is unsuccessful his members may transfer to a competing union or drop union membership altogether.

The settlements obtained by bargaining are set forth in written contracts between the unions and the employers. When the contract period ends new terms are negotiated.

After World War II, inflation of the currency caused prices to go steadily upward. Unions were unwilling to negotiate new contracts unless they contained *escalator clauses,* calling for automatic adjustment of wages to keep pace with rising living costs. The *Consumer Price Index* of the Bureau of Labor Statistics was used as a measure of prices (*see* Living Costs). When prices went up, pay was to be correspondingly increased. The escalator clauses also called for automatic reductions in pay if living costs should turn downward.

In a few contracts, year-to-year increases of production call for automatic pay increases to the entire pool of employees covered in the agreement. While this does not reward individual workers for their particular contributions to productivity gains, it is a sound economic development. Most early labor contracts severely restricted productivity gains by banning wage incentives such as *piecework* (work paid for at a rate based on the amount done rather than on the time employed). They also made it difficult to eliminate unproductive operations and useless jobs. Some contracts limited the introduction of more efficient laborsaving machines because the unions did not want their members to be displaced from jobs by technological improvements.

WORKERS IN AMERICAN INDUSTRY

The machines of industry are built, serviced, and run by such workers as these, with skillful hands and American know-how.

Science and Technology in Industry

Technology has made the skilled worker concerned about being displaced from his job by a machine. It is true that usually when a new machine is introduced, the same work is accomplished by fewer workers, thus causing *technological unemployment.* Soon, however, the larger volume of output at lower prices leads to greatly increased sales and to an increase in the number of workers originally employed. In practically all industries the number of workers has risen steadily with the introduction of new machinery.

Technology is becoming an ever more powerful factor in industry. The primary reasons for this are:

First, science has made tremendous progress. By breaking through frontiers to knowledge of new principles and by making practical applications of scientific theories, new methods and new products are developed.

Second, the public has come to understand the importance of science to national welfare as well as to the individual's convenience, wants, and health. As a result, increased encouragement has been given to the creation of research grants, scientific schools, and other activities in order to promote new discoveries and to spread scientific knowledge.

Third, industry itself has learned the value of financing pure scientific research in universities and related institutions.

Fourth, industry has become skilled at administering its own development laboratories where scientific discoveries may be applied and eventually used in mass production.

An industrialist must have considerable knowledge to comprehend in practical terms the implications of a new scientific development and its possible application to his own business. After some understanding is secured, he must have the courage to back his judgment with *venture capital*, sometimes called "seed corn" or "brave money." For example, the Du Pont company spent 27 million dollars over a period of 11 years in developing nylon before its first yarn-spinning machine was built, in 1939.

Industry's New Frontiers

Opportunities for geographical discovery have been diminishing ever since Columbus sailed to America. In contrast, the opportunities for penetrating industrial frontiers are ever increasing. Two of the numerous industrial frontiers bear particular promise.

The first frontier is technology. This powerful lever for multiplying industrial productivity exerts a constant challenge throughout all segments of industry. The technological frontier will be penetrated farther as industrial invention passes from the unguided phase of inspiration and accident to one of direction, program, and calculation of risks. Toward this end, industrial invention is becoming an established organized function of modern industrial management. The mounting importance of technology is shown by the growing number of technical people in industry. In 1928 there was one engineer for every 100 workers. In 1952 there was one engineer for every 40 workers. This figure is the average for all industries. There is added significance in the fact that some companies employ one engineer for as few as five production workers.

The second industrial frontier is even more complex. It has to do with people—how they may work together with dignity, satisfaction, and effectiveness. The opportunities for profitable and satisfying research on this frontier are even greater than those found in the application to industry of atomic energy and synthetic intelligence.

REFERENCE-OUTLINE FOR STUDY OF AMERICAN INDUSTRY

MANUFACTURING INDUSTRIES

I. **Food and kindred products:** meat products M-153; dairy products D-2; grain-mill products F-165, B-299; bakery products B-294; sugar S-443; confectionery and related products C-110, C-288, C-227; beverage industries C-288, C-376, T-28, G-156; miscellaneous products including spices and condiments S-339, B-18, O-377, F-44, Y-336. For the production, processing, distribution, and preservation of food products, see the Reference-Outline for Food

II. **Tobacco manufactures** T-142, picture T-144

III. **Textile-mill products, apparel, and other finished products made from fabrics and similar materials:** see the Reference-Outline for Clothing

IV. **Lumber and wood products (except furniture)** L-340, W-186. See also Wood in Fact-Index

V. **Furniture and fixtures** F-317, I-176-85

VI. **Paper and allied products** P-66, W-4

VII. **Printing, publishing, and allied industries** P-413: books and bookmaking B-242-5; bookselling and publishing B-247-9; magazines M-29; newspapers N-186. See also Printing in Fact-Index

VIII. **Chemicals and allied products**

- A. **Industrial inorganic chemicals:** see the Reference-Outline for Chemistry, section Types of compounds
- B. **Industrial organic chemicals:** coal-tar products C-370; dyes D-165; plastics P-310; synthetic rubber R-244, picture R-245; synthetic fibers F-62-3 (rayon R-79; nylon N-317; cellulose, picture U-281); drugs and medicines D-156 (antibiotics A-266-8); solvents (alcohol) A-145; soap and glycerin S-211, G-127; paints and varnishes P-40; gum and wood chemicals G-232, W-186*d*; fertilizers F-55; animal and vegetable oils F-44-5; perfumes P-147; glue and gelatin G-127, G-35; compressed and liquefied gases G-30-1
- C. **Silicones** S-180

IX. **Products of petroleum and coal:** petroleum refining P-174-8, color picture U-282; coke and by-products C-380; fuels F-314

X. **Rubber products** R-239, pictures R-241-5

XI. **Leather and leather products** L-147-50. See also Leather in Fact-Index

XII. **Stone, clay, and glass products** C-339, G-119: cement C-165; gypsum G-236; pottery and porcelain P-399, pictures P-400, 401; brick and tile B-302, pictures B-303; glass, pictures G-120-122*b*

XIII. **Primary metal industries**—steelworks and rolling mills, iron and steel foundries, smelting and refining metals

- A. **Blast furnaces, steelworks, and rolling mills** I-235, diagrams I-236-7, 240-1, pictures I-235, 238, 239, 242-5
- B. **Iron and steel foundries:** this group includes foundries primarily engaged in manufacturing gray-iron, malleable-iron, and steel castings. See Castings in Fact-Index
- C. **Nonferrous metals, including alloys, which are smelted and refined:** copper C-473, pictures C-474; lead L-141; zinc Z-351; aluminum A-182; magnesium M-41; alloys A-172-5. This group also includes gold G-131; silver S-186; platinum P-314; cobalt C-372; nickel N-234; tin T-137; antimony A-264; iridium, Fact-Index

Note: The primary-metal industries also include the rolling, drawing, and alloying of nonferrous metals, nonferrous foundries, and miscellaneous primary-metal industries such as iron and steel forgings, wire drawing, and welded and heavy-riveted pipe.

XIV. **Fabricated metal products (except ordnance, machinery, and transportation equipment):** tin cans and other tinware T-137; cutlery, hand tools, and general hardware K-59, T-148-54, L-289; heating apparatus (except electric) and plumbers' supplies H-321-6, P-326; fabricated structural metal products B-344; metal stamping, coating, and engraving (automobile stampings, pictures T-149, A-507, U-321; enameling and lacquering E-341, L-81; engraving on metal E-385; electroplating E-321); fabricated wire products W-161

XV. **Machinery (except electrical)** M-13: steam engines S-386; diesel engines D-89; agricultural machinery and tractors A-59-61, pictures A-63, 64, 65. (This group also includes construction, mining, and metalworking machinery; special and general industrial machines; and office, store, service industry, and household machines.)

XVI. **Electrical machinery, equipment, and supplies**

A. **Electrical generating, transmission, distribution, and industrial apparatus:** generators and motors E-289; power and distribution transformers T-167; switchgear, switchboard apparatus, and industrial controls R-67-8, T-41-2, picture R-47; electrical welding apparatus W-90

B. **Electric appliances** E-312*b*-313

C. **Insulated wire and cable** W-163

D. **Electric lamps** E-310-11

E. **Communication equipment and related products:** see the Reference-Outline for Communication

Note: The above group also includes electrical equipment for motor vehicles, aircraft, and railway locomotives and cars.

XVII. **Electronics in industry** E-317-21: photoelectric devices P-209-210*a* (in radio R-37-8; in television T-53-54c); electron microscope M-236, picture M-234

XVIII. **Transportation equipment:** motor vehicles A-508-11; aircraft A-97, picture A-98; ships S-156-9; railroads R-60-69*d*; bicycles and motor cycles B-141-3. See also the Reference-Outline for Transportation

XIX. **Professional, scientific, and controlling instruments; photographic and optical goods; watches and clocks:** see in Fact-Index Optical instruments; Photography; Watches; Clocks

XX. **Miscellaneous manufacturing industries:** jewelry and silverware J-347, M-177; musical instruments M-470; toys T-160 (dolls D-121); pens and pencils P-114, P-116; brooms and brushes B-330; cork products C-479; matches M-140; candles L-90; fireworks F-93; signs and advertising displays E-314, A-26, picture A-400*e*

NONMANUFACTURING INDUSTRIES

I. **Agriculture, forestry, and fisheries**

A. **Farms and agricultural services** F-21-36. See also the Reference-Outline for Agriculture

B. **Hunting and trapping** T-176-7, F-321-6, H-438. See also Furs, table in Fact-Index

C. **Forestry** F-236-41. See also in Fact-Index Forests and forestry; Forest service

D. **Fisheries** F-112-18: principal food fishes of the world, list F-108-9; fish culture F-110-12; seals and sealing S-88-90; whales and whaling W-111-14. See also in Fact-Index Fisheries

II. **Mines and mining** M-267-75, M-176: coal C-361; copper C-473; gold G-131; lead L-141; silver S-186; uranium U-405; zinc Z-351; diamonds D-78; crude petroleum and natural gas P-168, G-31

III. **Engineering and construction** E-345-6, B-343-7. See also the Reference-Outline for Architecture

A. **Highway and waterway construction:** bridges B-305; canals C-107; harbors and ports H-262; lighthouses L-235; railroads R-60; roads R-158c, pictures, R-158*d*; tunnels T-207

B. **Sanitation:** aqueducts A-283; plumbing P-322; sewerage S-110; waterworks W-71

C. **Irrigation and reclamation** I-250-2: dams D-6

D. **Mine construction,** pictures M-269

IV. **Transportation and communication:** see the Reference-Outlines for Transportation and Communication

V. **Finance and insurance:** banks and banking B-47-53; insurance I-166-70

VI. **Services (general):** radio broadcasting R-44-51; motion pictures M-407-34; medical and other health services M-164-5 (hospitals H-429; nursing N-314); legal services L-139-40; educational services E-260-3, U-402 (libraries L-186-99)

Note: The services group also includes real estate; hotels, rooming houses, camps, and other lodging places; personal services; miscellaneous repair services; amusements (other than motion pictures); museums, art galleries, and botanical and zoological gardens; nonprofit membership organizations; private households.

VII. **Government** G-144-6. See also the Reference-Outline for Political Science

INDUSTRIAL TRAINING AND MANAGEMENT

I. **Training:** schools S-58; universities and colleges U-400, C-383; vocations V-502-3

II. **Management:** see the Reference-Outline for Economics

III. **Industrial leaders and inventors:** see the Reference-Outline for Industrial Revolution

INDUSTRIAL DESIGN AND GRAPHIC ARTS

I. **Industrial design** A-400*f*, *g-j*: the modern automobile, picture A-400*i*; modern architecture and interior design, pictures A-400*f*, A-324

II. **Graphic arts (from the industrial viewpoint)** A-400*j-k*: printing P-413; photoengraving and photolithography P-210*a*; type and typography T-228; linotype L-256; monotype M-361

HOME AND SCHOOL APPLICATIONS

I. **Basketry and related work:** how to make a simple basket B-74; knots, hitches, and splices K-59

II. **Woodworking and wood carving** W-190-1: how to build birdhouses B-187-8, diagrams B-189; how to build a model airplane A-107-10

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BIBLIOGRAPHY FOR AMERICAN INDUSTRY

Baity, E. C. Man Is a Weaver (Viking, 1942).
Bendick, Jeanne. Electronics for Young People (McGraw, 1947).
Bendick, Jeanne and Robert. Television Works Like This (McGraw, 1949).
Britton, Katharine. What Makes It Tick? (Houghton, 1943).
Burlingame, Roger. Inventors behind the Inventor (Harcourt, 1947).
Eberle, Irmengarde. Basketful; the Story of Our Foods (Crowell, 1946).
Ewbank, H. L., and Lawton, S. P. Broadcasting; Radio and Television (Harper, 1952).
Glover, J. G. and Cornell, W. B., eds. Development of American Industries (Prentice-Hall, 1951).
Hawley, G. G. Small Wonder; the Story of Colloids (Knopf, 1947).
Hibben, Thomas. Sons of Vulcan: The Story of Metals (Lippincott, 1940).
Landis, W. S. Your Servant, the Molecule (Macmillan, 1944).
Lent, H. B. O. K. for Drive-Away (Macmillan, 1951).
Mersereau, S. F. Materials of Industry (McGraw, 1947).
Metcalfe, J. M. Aluminum from Mine to Sky (McGraw, 1947).
Metcalfe, J. M. Copper, the Red Metal (Viking, 1944).
Perry, Josephine. Light Metals Industry (and others in same series) (Longmans, 1947).
Perry, T. D. Modern Plywood (Pitman, 1948).
Phillips, C. J. Get Acquainted with Glass (Pitman, 1950).
Schackne, Stewart and N. D. Oil for the World (Harper, 1950).
Seaver, C. H. Industry in America (Harper, 1950).
Shippen, K. B. Great Heritage (Viking, 1947).
Stuck, F. T. Vocational Education for a Changing World (Wiley, 1945).
Van Metre, T. W. Trains, Tracks and Travel (Simmons-Boardman, 1950).
Walker, J. B. Epic of American Industry (Harper, 1949).
Wolfe, Bernard. Plastics (Bobbs, 1945).
Yates, R. F. Boys' Book of Communications (Harper, 1942).
(*See also* bibliographies for Agriculture, Clothing, Communication, Economics, Food, Plastics, and Transportation.)

Books That Tell How to Do Things

Beeler, N. F. and Branley, F. M. Experiments with Electricity (Crowell, 1949).
Black, M. E. Key to Weaving (Bruce, 1949).
Carlson, B. W. Make It Yourself (Abingdon-Cokesbury, 1950).
Crouse, W. H. Home Guide to Repair, Upkeep, and Remodeling (McGraw, 1947).
Deschin, Jacob. Fun with Your Camera (McGraw, 1947).
Fowler, H. W., Jr. Kites (Barnes, 1953).
Freer, Marjorie. Gifts to Make at Home (Studio, 1952).
Gilmore, H. H. Model Planes for Beginners (Harper, 1947).
Hardy, Kay. How to Upholster Furniture (Funk, 1952).
Hertz, L. H. Complete Book of Model Railroading (Simmons-Boardman, 1951).
Honoré, York. Pottery Making from the Ground up (Viking, 1941).
Jaeger, Ellsworth. Nature Crafts (Macmillan, 1950).
Johnson, W. H. and Newkirk, L. V. General Woodworking (Macmillan, 1949).
Korasz, Marisko. Design and Sew (Lippincott, 1946).
Leeming, Joseph. Fun with Plastics (Lippincott, 1946).
Maginley, C. J. Historic Models of Early America and How to Make Them (Harcourt, 1947).
Maginley, C. J. Toymaker's Book (Harcourt, 1948).
Mannel, Elise. Leathercraft Is Fun (Bruce, 1952).
Morgan, A. P. Boys' Book of Engines, Motors and Turbines (Scribner, 1946).
Morgan, A. P. Tools and How to Use Them for Woodworking and Metal Working (Crown, 1948).
Perkins, W. L. Fannie Farmer Junior Cook Book (Little, 1942).
Roberts, Catherine. Make It and Make It Pay (Houghton, 1949).
Schock, E. I. How to Build Small Boats (Barnes, 1952).
Zaidenberg, Arthur. Anyone Can Sculpt (Harper, 1952).
Zarchy, Harry. Let's Make a Lot of Things (Knopf, 1948).
(*See also* bibliography for Hobbies.)

INFRARED RADIATION (RAYS). The story of "heat rays" and "black light" begins about 1800. In that year, an English astronomer, Sir William Herschel, attempted to prove one of his theories. He believed that each color into which a prism separates the sun's rays has different physical properties. To check this theory he tested each band of color for heat.

First he placed a prism where the sun's rays would strike it. The prism separated the white rays into red, yellow, green, blue, indigo, and violet bands. Next he held a thermometer in each of the colors. As he moved the thermometer from band to band, Herschel noticed a steadily increasing heat toward the red end. Finally, he edged the thermometer just outside the red band, where there was no light at all. The temperature was *higher than ever*. Sir William had discovered an invisible radiation just outside the red band of the sun's spectrum—a ray with the power to produce great heat.

A year later, a German chemist, Johann Wilhelm Ritter, found invisible rays outside the violet band of the spectrum. These rays were named *ultraviolet*, meaning "beyond the violet" (*see* Ultraviolet). So physicists named the rays at the other end of the spectrum *infrared*, meaning "below the red."

What Are Infrared Rays?

Since Herschel's time, physicists have found out a great many things about these rays. Today the

physicists believe that infrared rays are just like visible light, except for one important difference. This is in the rate of the vibrations that carry both light and infrared rays through space.

As the article on Light explains, all light has the nature of a vibration. These vibrations travel through space like waves at a speed of about 186,000 miles a second. The difference between infrared and visible light is that the vibration rates of infrared are somewhat slower. In other words, the frequency of infrared is *lower* than the frequency of visible light. As a result, wave lengths are longer than the wave lengths of visible light. The entire range of infrared wave length is from the point where the infrared zone overlaps the shortest radio waves to where it overlaps the deep red of visible light.

The length of infrared waves gives the rays great penetrating power. The frequency of the shorter and middle range infrared waves also gives them power to stimulate molecules to great activity. Physicists of the 20th century have found hundreds of ways to put these two properties to work.

Uses for Infrared Rays

A great many people call infrared rays "heat rays," because they are used for "deep heat" in medicine and industry. Actually infrared rays are not warm at all. What they do is to *produce* heat by stimulating the motion of molecules in the objects they strike (*see* Heat). On the other hand, molecular activity will produce infrared rays. This is the way the sun sends heat across empty space to the planets.

Ordinary tungsten-filament lamps will make infrared rays. So it is easy to produce them. In medicine, rays from infrared lamps stimulate circulation in the tissues of arthritic and rheumatic patients.

In the automobile industry, batteries of infrared lamps are turned on freshly painted cars. The rays penetrate deeply and dry many layers of paint at the same time. They will dehydrate food in record time and save many of the precious vitamins that would be lost over a long drying period. The rays are even used to bake bread and to keep cars from freezing.

Another popular name, "black light," comes from the use of the rays in photography and in wartime night-sight devices. The rays are so penetrating that photographers can train beams of infrared on objects as much as 250 miles away. Then, using special infrared sensitive film, they can take a picture of the object.

In the second World War, infrared rays provided the Allies with two night-sight devices, the *sniperscope* and the *snooperscope*. Each device has an infrared projector, a telescopic tube, and a power pack. The soldier turns on the power, and the projector sends out strong beams of invisible infrared rays. The powerful rays penetrate smoke and haze to "light up" everything ahead with their unseen brilliance. As soon as they strike a solid object, they are reflected back. The telescope lens picks up returning rays and focuses them on a special film inside the tube. Wherever the film is struck, it emits electrons. An electronic lens focuses the electrons on a fluorescent screen at the back of the telescope. The screen shows a glowing image of the object which reflected the rays.

Another wartime use for infrared was in telephonic equipment. Both German and Allied scientists figured out ways to send out infrared waves so that they could be picked up by a photosensitive receiver and converted to audible sound.

How Infrared Rays Are Detected

Some infrared rays may be so weak that they do not even produce a feeling of warmth when they strike our hands. Sir William Herschel detected such rays with a thermometer. A super-thermometer called the *bolometer* registers extremely weak infrared waves.

One kind of bolometer is made up of a series of columbium nitride strips cooled to −423° F. At this temperature, columbium nitride is "super-conductive," that is, it offers almost no resistance to electric current. When an infrared ray warms it even one-millionth of a degree, the bolometer gives a clear electric signal. Attached to a special electronic device and a camera, the bolometer can use heat rays from a man's body 500 yards away to take a picture.

A device like the bolometer has a great future in detecting invisible objects by the infrared rays they give off. For example, it could be used at sea to show the location of ships in a fog by the heat from their funnels. In the infrared spectral recorder a photoelectric cell translates weak infrared rays from the planets into electric current, which is amplified about 10 million times. This device helps us to study conditions on distant planets.

INITIATIVE, REFERENDUM, AND RECALL. The constitution makers of the early United States distrusted the ability of the people to govern themselves directly, and so introduced a system of checks and balances, and indirect government through elected representative assemblies holding office for a definite period. The acts of Congress and legislatures were subject not only to the veto of the president or governor, but to review by courts appointed generally for life. Times have changed since then, and today the people seek to curb somewhat the authority of their representatives. Three of the modern weapons in the fight to place more direct power in the hands of the people are the initiative, referendum, and recall.

The first two are methods of controlling the lawmaking body. Your Latin will tell you the meaning of the terms: initiative from *initio*, meaning "begin," and referendum from *refero*, "carry back." The initiative then is the means by which the people may begin making a law, and the referendum the means by which they may act upon a law already passed.

Of these two the referendum is the older. It was in use in some of the Swiss cantons as early as the 16th century. When the United States was formed three of the new state constitutions were referred to the people for their approval; and by 1820 the referendum on constitutional questions was generally in use in this country. Local matters, such as locating county

seats, borrowing money, etc., were also submitted to localities affected, even in colonial times. But not until 1898 did a state confer upon its citizens the right to vote upon legislation already enacted. In that year South Dakota passed a law to that effect; many states followed its example. Under the referendum, any citizen believing a law to be bad can circulate a petition asking that it be submitted to a popular vote. To succeed, the petition must be signed by from 5 to 10 per cent of the registered voters (the proportion varies in different states).

The next step was logical. If citizens could reject laws passed by representatives, why were they not capable of originating laws neglected by the legislators? Oregon, under the leadership of lawyer-reformer William U'Ren, began the movement in 1902 and the "Oregon Plan" has been followed by other states. The details of the initiative laws, like those for the referendum, differ in different states. In some the bill is placed on the ballot as soon as the petition is filed. In others it must be submitted to the legislature and then, if that body refuses to act, it goes to the people.

The recall controls officials rather than legislation. It is a method for removing unsatisfactory men from office before the end of their terms. This is usually accomplished by holding a new election whenever a certain proportion of the voters demand it. To keep his place, the official in question must defeat the candidate of the opposition.

INK. Ever since writing was invented men have wanted ink that would make a permanent mark and be convenient to use. What was probably the very earliest ink remains today the most nearly permanent. This is the so-called carbon ink made of soot mixed with glue and water. Egyptian documents written with this ink more than 4,000 years ago are still black and clear. But carbon ink tends to cake in the bottle and on pen points, and it clogs a fountain pen immediately.

A good modern writing ink combines permanence with convenience by including in its make-up two kinds of substances—an organic dye and an inorganic metallic salt. With reasonable protection from exposure the dye keeps its color indefinitely. But if air and sunlight do oxidize and *fade* the organic dye, the same chemical reaction will oxidize and *darken* the inorganic salt. Thus the writing remains visible.

Synthetic dyes made from coal tar are commonly used to produce the characteristic colors—black, blue, red, green, etc. A standard formula for blue-black writing ink, published by the United States Bureau of Standards, calls for a blue dye, gallic acid, ferrous sulphate, and tartaric acid. In the presence of the tartaric acid, the gallic acid forms a relatively colorless compound with the iron salt, but as this compound slowly oxidizes it turns black.

For centuries some of the best writing inks were made without dyes, simply by mixing ferrous sulphate (the "green vitriol" of the alchemists) with gallic acid and water, and allowing it partially to darken before use. The dark insoluble pigment formed by oxidation was prevented from settling by the addition of gum arabic or some other water-soluble gum.

The gallic acid used in making these inks was produced by the fermentation of tannic acid, extracted from nutgalls imported from China and Turkey. Nutgalls are growths that form on oak trees when gallflies lay their eggs in the bark (*see* Oak).

The color of these pre-oxidized inks was sometimes modified by the addition of indigo or logwood extract, and later of coal-tar dyes. In permanence these inks equaled the more modern writing fluids, but they tended to thicken and to deposit sediment. They were not satisfactory for fountain pens.

Fountain-Pen Inks

Ink for fountain pens must be exceptionally free-flowing and must contain nothing that will attack the rubber sac of a self-filling pen. Some fountain-pen manufacturers prepare special inks for their own pens.

Ingredients that may be added include substances like glycerin to prevent evaporation, chemicals to prevent mold, solvents to hold the dyes in solution, and wetting agents to help the flow and let the ink penetrate rapidly into the paper. One type of ink, made with an alkali, sinks into the paper and dries instantly. Since the iron salts used in ordinary ink-making are not soluble in an alkali, vanadium and molybdenum salts are used. This ink is so free-flowing that it requires a specially designed fountain pen.

Drawing Inks and Some Others

The black drawing ink (India ink) used by artists and draftsmen today closely resembles the ancient carbon ink of the Egyptians. It is made from "gas black" or "carbon black." This is the soot or carbon dust that forms on a cold porcelain plate if you lower it into a yellowish, smoky gas flame. The carbon dust is suspended in water containing small amounts of glue and soap. The ink can be made waterproof by adding a solution of shellac containing borax and ammonia. To make colored drawing inks, suitable dyes are substituted for the carbon black.

Prussian blue, a compound of iron and cyanide, is mixed with water and oxalic acid to form a permanent waterproof ink suitable for use with dip pens. It resists ink eradicators, but can be washed off with soap. Other washable inks are made with water-soluble dyes. They can usually be removed from cotton, linen, and rayon more easily than from silk and wool.

The marking ink used by laundries to identify garments usually is made of silver nitrate dissolved in water and ammonia. Sepia ink, one of the most lasting of the natural inks, is made from a fluid produced by the "ink gland" of the cuttlefish or squid. Before the discovery of coal-tar dyes, a brilliant red ink used to be made of the dried bodies of the tiny cochineal insects (*see* Cochineal).

Inks for Secret Writing

The so-called invisible or sympathetic inks are those that do not show on the paper when they are used.

Some of the favorite secret inks are lead acetate solution, whose invisible marks turn black upon exposure to sulphureted hydrogen; cobalt nitrate solution, which turns blue when it is treated with oxalic acid; cobalt chloride or nitrochloride, which becomes green when heated; and starch water, which turns blue in iodine fumes. Lemon juice will produce writing which will not be noticed when dry, but which stands out sharply in brown when the paper is warmed.

Duplicating and Printing Inks

Duplicating inks can produce several hundred copies from the original writing. This remarkable copying power derives from the intense colors of a few violet and blue dyes. Stamp-pad and typewriter-ribbon inks are closely related to duplicating inks. Carbon paper for making duplicate copies is paper coated with a mixture of waxes and oils containing carbon black or colored dyes.

Printing inks are made in the form of a paste which is applied to the printing surface by rollers. These inks vary greatly in composition and consistency, depending on the printing process employed (*see* Printing; Photoengraving). The printing ink vehicle may be a vegetable, rosin, or mineral oil mixed with a volatile solvent. Pigments also vary. The pigment may be a natural inorganic substance, such as kaolin; an artificial inorganic substance, as chrome yellow; or one of the many artificial organic substances. Black is nearly always derived from *gas black*, made by burning a hydrocarbon gas in a limited supply of air.

For advertising purposes, printing ink may be permeated with an odor, such as perfume. Another special advertising ink is the brilliantly colored *fluorescent* ink. The fluorescent pigment is made by dissolving fluorescent dyestuff in a clear thermosetting resin plastic. It is then ground in with the vehicle. On a poster, for example, the fluorescent color glows in response to light striking it.

INNOCENT, POPES. Thirteen popes have borne this name, beginning with INNOCENT I, who was in office from 402 to 417. He was an able and energetic man, who lost no opportunity to assert the papal power, but his reign was disturbed by Alaric's sack of Rome in 410. INNOCENT II (Pope, 1130–1143) condemned the scholar Abelard for heresy.

INNOCENT III (Pope, 1198–1216) was in many respects the ablest and most powerful pope of the Middle Ages. His lofty and severe character inspired universal respect. He greatly strengthened the temporal power of the papacy. In addition to the Papal States, which he ruled in Italy, he had as vassal states under him Sicily and Naples, Sweden, Denmark, Portugal, Aragon, and Poland. It was to him that King John surrendered England, receiving it back from the pope's legate as a fief. He also put in practice the papal claim to set up and pull down emperors of the Holy Roman Empire, as in the case of Philip of Swabia and Otto IV. During his 18 years on the papal throne the Fourth Crusade and the Latin conquest of Constantinople occurred.

INNOCENT VII (1404–1406) was one of the popes during the Great Schism of the Church. Under INNOCENT VIII (1484–1492) corruption reigned in Rome. INNOCENT X (1644–1655), INNOCENT XI (1676–1689), and INNOCENT XII (1691–1700) were all reforming popes, who combated heresy and sought to improve the Roman administration. The others require no separate mention.

INQUISITION. To check the waves of heresy that swept over Europe in the 13th century, the Church of Rome established a special tribunal called the Inquisition to try persons accused of revolting against religious authority. Up to that time heresy trials had been conducted by the local bishops. The new Inquisition courts, which soon were put in the hands of the Dominican friars, were able to carry forward the work on a broader scale.

Arriving in a district, the judges, aided by the local bishop and the state authorities, would announce 30 days' grace for all heretics to come in and confess their crime. When that period was up the trial of the accused and unrepentant ones began. The names of witnesses were kept secret, but the defendant was permitted to submit a list of enemies, and none of these might appear against him. Following the frequent practice of the period in criminal trials, torture was often used to force confessions of guilt.

At a grand ceremonial, called *sermo generalis* or *auto-da-fé*, the names of the guilty were announced and punishments inflicted, ranging from fines and excommunication to imprisonment for life or burning at the stake for incorrigible heretics. Since canon law forbade the clergy to participate in bloodshed, the severer penalties were carried out by the state.

The Inquisition reached its height in Spain during the days of King Ferdinand and Queen Isabella, when Fray Tomás de Torquemada (1420–1498) was made inquisitor general for the kingdom. Here the crown exercised almost complete control over the Inquisition and carried it to extremes, often coming in conflict with the authorities at Rome.

The Inquisition was sometimes used as a cloak for political and private revenge. At times the sincerest inquisitors were misled by fanatical zeal and they practiced great cruelties. On the whole, the institution was a logical product of its time. In those days the church and state were united in the closest bonds, and heresy was considered a crime against both, to be compared only with high treason and anarchy. To the people of the period it seemed as reasonable to punish a man who "plotted against the life of the church" as it would in our day to punish a man who plotted against the existing government.

The Inquisition was chiefly active in southern Europe and in parts of Latin America. It continued in modified form in Spain until 1820. The Congregation of the Holy Office, established by Pope Paul III in 1542 to review the judgments of the Inquisition courts, still exists. It examines charges of heresy, but it has power to impose only spiritual punishments such as excommunication.

The Amazing WORLD *of the* INSECTS

A dragonfly hovering over a water lily is a beautiful object. Compare this insect, with its long body and great wings, to one of its tiny wingless cousins—a flea, for example. The insects differ tremendously in structure and in habits.

INSECTS. The most abundant of all creatures are the insects. Far more different kinds are known than all the four-footed animals, the birds, and the fishes taken together. Insects have been so successful in their struggle for survival that they are often called the rivals of man for mastery of the earth.

Scientists, called entomologists, who study insects, have named about 670,000 species. That is perhaps less than a third of the actual total. Each year more than 5,000 new species are discovered and described.

Insects live almost everywhere that life of any kind is possible. They dwell in the icy polar wastes, in scorching deserts, in fresh and salt water.

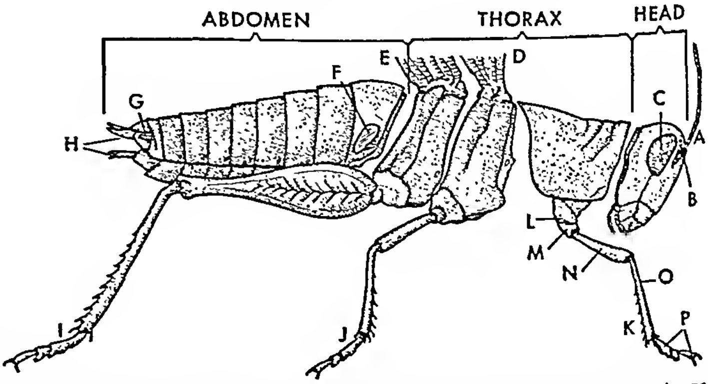
Reasons for Insect Success

Their success in surviving is due to several factors. Insects are small or even minute in size. Little creatures find it easier to escape enemies and to live through extremes of hot or cold, rainy or dry climate. Moreover, a small food supply can support more of them. In a meadow where a few cows are pastured may live myriads of unseen insects. Another reason for survival is that they produce great numbers of young. Insects have many enemies. The adults lead brief and dangerous lives, and countless young are killed before they can mature. They would soon be wiped out if they didn't reproduce at an enormous rate. It is estimated that the young of a pair of flies could blanket the globe to a depth of about 50 feet within four months if each of the young lived to reproduce. A single queen termite can lay millions of eggs, occasionally at the rate of 60 a second. The queen honeybee can lay 2,500 eggs a day. Most insects, however, lay no more than 150 to 200 eggs in a lifetime.

Most important in the struggle for survival is the remarkable *adaptability* of the insects. They have developed marvelous structures and instinctive habits to fit widely varying conditions of life. And they can alter their habits to a great degree to meet new conditions.

Some insects join in social groups and carry on the battle of life by dividing their work. In an ant colony, for example, some members specialize in reproduction, some in food gathering, some in fighting. Their interdependence is so absolute that no single member of the group could survive without the help of the others (*see* Ant; Bee). Other insects carry on the struggle as individuals, even to the extent of preying upon their own kind (*see* Mantis). The clothes moth provides an example of change to meet a new situation. It feeds largely on man-made materials. Before clothes were invented it probably lived in bird and bee nests or under dead bark, where we sometimes find it. Beetles fur-

THE PRINCIPAL PARTS OF AN INSECT



The short-horned grasshopper is a typical insect. Here we see: (A) antenna; (B) ocellus, or simple eye; (C) compound eye; (D,E) fore and hind wings; (F) tympanum, or "ear"; (G) cercus, appendage at end of abdomen; (H) ovipositor, or egg-laying organ; (I,J,K) hind, middle, and fore legs; parts of the leg: (L)coxa; (M) trocbanter; (N) femur; (O) tibia; (P) tarsus.

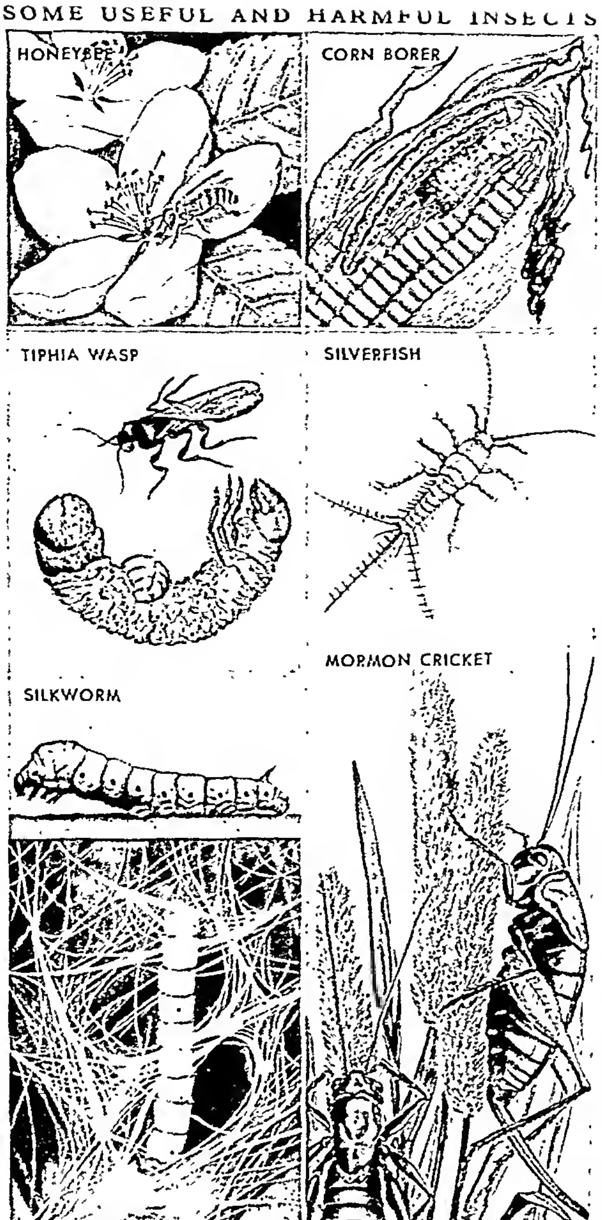
nish many other striking instances and problems of this kind (*see* Beetles).

Harmful and Useful Insects

The first law of insect life is to eat without being eaten. Because there are so many insects, they have learned to eat almost anything, including one another and man. And in getting their food some of them aid man and others cause him great trouble and expense. The section, "Insect Pests That Cost Man Billions of Dollars Yearly," tells about the harmful kinds.

Not all insects are pests, however. In fact, life would be very different without them. Many plants depend on insects to pollinate them. That is, the insects, in visiting the flowers for nectar, carry pollen from one flower to the pistil of another. Thus they fertilize the plant and enable it to make seed and new plants (*see* Flowers). Flowers appear to have developed their beauty of color and form, and their perfume to attract insects, chiefly bees and certain moths. Without them we would have none of the familiar orchard fruits and berries. Tomatoes, peas, beans, onions, cabbages, and many other vegetables would be missing from our tables. There would be no clover and alfalfa. So the animals which feed on these forage crops, like cattle and hogs, would be of poor quality, and our meat supply would suffer. We would have no linen or cotton, no tea, coffee, cocoa, chocolate.

SOME USEFUL AND HARMFUL INSECTS



The honeybee is one of the most useful of all insects because of its work in pollinating flowers. The larva of the tiphia wasp feeds on the Japanese beetle grub and so kills this serious pest. Silkworms produce the thread from which we make silk textiles. The corn borer is the unpleasant surprise in many an ear of corn. Silverfish eat the starch in book bindings and clothing. Mormon crickets migrate in huge numbers, eating all green plants in their path.

Many useful products are obtained from insects. The honeybee produces honey and beeswax. Silk is made by the larva of the silkworm. Shellac is a secretion of an Indian scale insect. Cochineal dye is made from the dried bodies of another scale insect.

Harmful insects, such as the plant eaters which destroy our food crops, are kept in check by their enemies, the predatory and parasitic insects. These are the kinds that eat other insects, or live on or in their bodies and eventually weaken or kill them. Numerous parasitic wasps and flies have been brought into the United States to combat the Japanese beetle, European corn borer, and gipsy moth. Predaceous lady beetles have been introduced from Australia to control mealybugs and other scale insects. Insects are also used to control unwanted plants. In California two species of European beetles have been established to control St. Johnswort, a weed poisonous to cattle and sheep.

Indirectly, insects are important to us as the food for other animals. Fresh-water fishes, particularly the game species, depend largely upon insect food. Most of us know that birds are useful because they eat insects and thus keep down their numbers. But how many of us realize that hundreds of beloved species of birds would perish if there were no insects for them to eat? Even those that prefer weed seeds as adults give insect food to their nestlings.

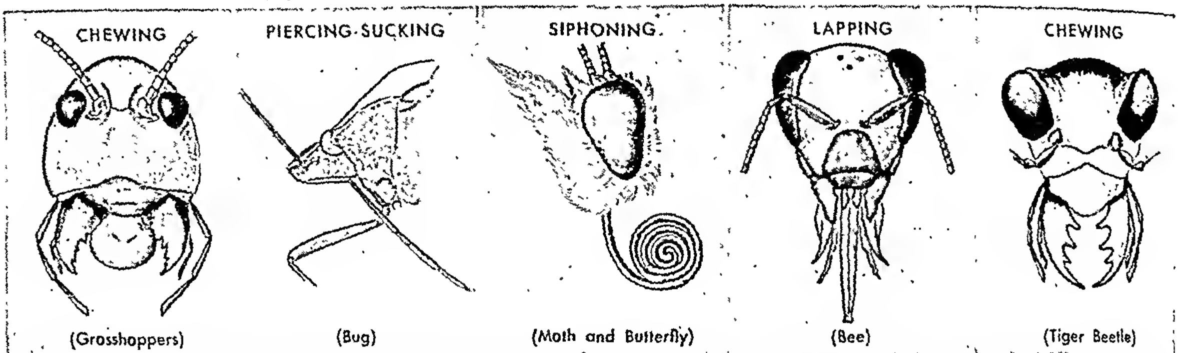
Thus, like grass and the tiny organisms that make up the plankton of lakes and oceans, insects are one of the great basic food sources drawn upon, either directly or indirectly, by a pyramiding array of animals.

The Structure of Insects

Just exactly what is an insect? All adult insects have six legs. This feature gives them the scientific name *Hexapoda* (from the Greek words *hex*, "six," and *podes*, "feet"). Their bodies are always made up of segments or rings joined together. A great many creatures closely resemble insects and are often mistaken for them—for instance, spiders and scorpions, which have eight legs; centipedes, with dozens of legs; mites and ticks, which have sacklike bodies unbroken by segments. The name "bug," carelessly applied to insects in general, really belongs to certain kinds of insects that have piercing-sucking mouth parts.

The body of an insect has three parts—head, middle section or thorax, and hind section or abdomen. It is covered with a horny substance called

SOME TYPES OF INSECT MOUTH PARTS



The mouth parts of different insects vary with their feeding habits. In general, they are divided into two kinds of mouth parts—chewing and sucking. Grasshoppers have mouths adapted to chewing plants. Beetles may use their jaws to grasp and tear apart other insects. Bugs, moths, and butterflies have mouth parts specialized so as to form a hollow tube through which they may suck up liquid foods. Bugs and mosquitoes pierce their food first and then suck its juices. Bees have a combination of chewing and sucking mouth parts.

chitin (pronounced *kī'tĭn*). This outside armor plate serves as an external skeleton for the support of the muscles, nerves, and other internal organs. The head bears the delicate feelers or antennae, the mouth parts, and the eyes. The thorax has three segments. On each segment is a pair of legs. And in the winged insects the second and third segments also bear the wings. The abdomen has three to eleven segments. It contains a large part of the digestive tract and the reproductive systems and the egg-laying organ, the ovipositor, of the female.

> The color pictures on the next four pages show examples of insect life from the primitive to the most advanced. Some of the paintings were prepared for Compton's Pictured Encyclopedia by SuZan Swain. Others (by the same artist) are reproduced from 'The Insect Guide', by Ralph B. Swain (copyright 1948 by Ralph B. Swain and reprinted by permission of Doubleday & Co., Inc.). The numbers, such as ×30, show the amount of magnification.

The Internal Organs

The nervous system includes a brain and a pair of parallel nerve cords extending the length of the underside of the body. Along the nerve cords are a series of nerve masses called ganglia. Each ganglion controls certain activities and is more or less independent of the others. An insect may lose its head and go on about its activities until it dies of starvation.

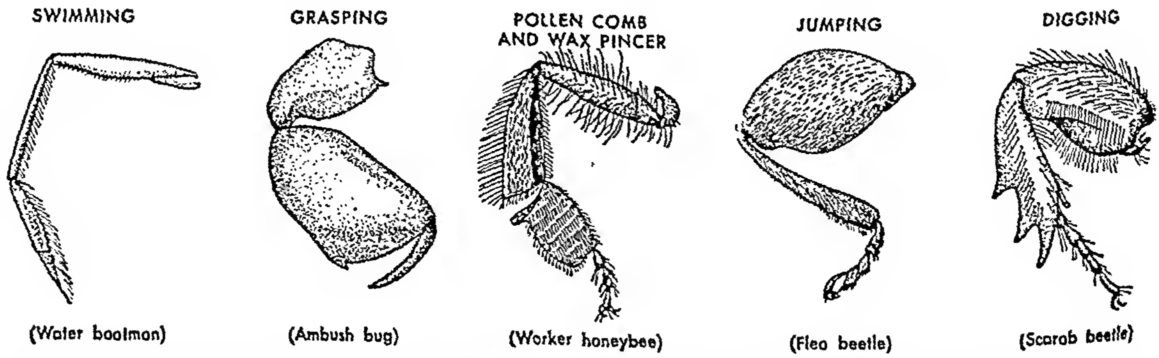
The blood is a greenish, yellowish, or colorless fluid. It is not enclosed in a system of arteries, veins, and capillaries as it is in mammals, but fills the body cavity. It is circulated by a long tube which extends the length of the body along the center of the back. The tube has intake openings along its sides, and opens at each end. By means of muscle fibers in its walls, it draws the blood in through the side openings and pumps it forward into the head cavity and out again into the body. The contractions of the "heart" are easily seen in light-colored caterpillars, and in various other larvae and pupae.

Air enters the body through breathing pores called spiracles. A pair of spiracles is usually found on each of two thoracic segments and the first six or eight abdominal segments. From the spiracles, air tubes called tracheae (large) and tracheoles (small) lead the air to all parts of the body. Some water insects breathe by means of gills. Certain internal parasites and very primitive insects breathe directly through the body wall.

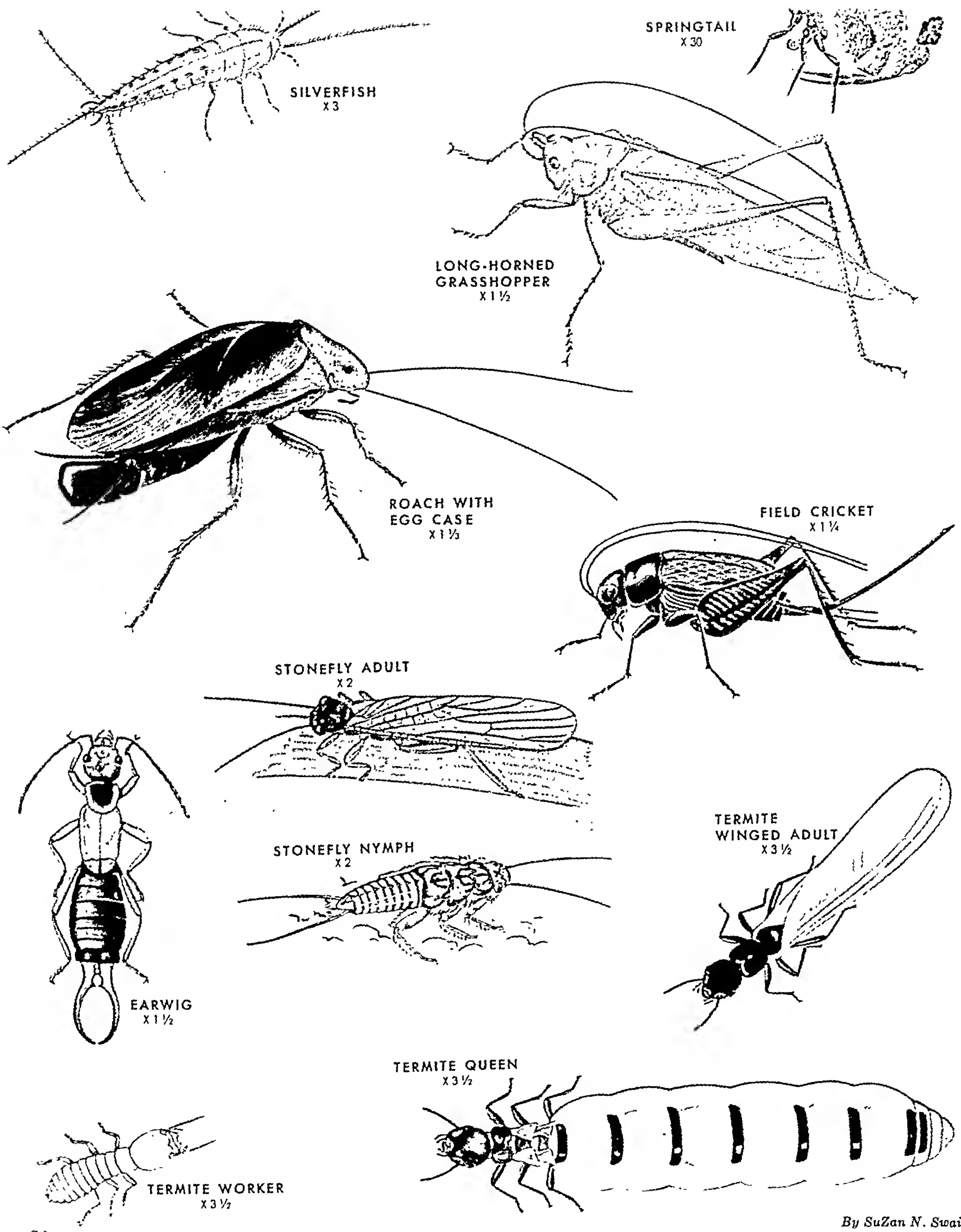
Eyes and Antennae

Insects, with the exception of certain cave-dwelling species, have well-developed sight organs. There are two general types—the large compound eyes

MODIFICATIONS OF THE INSECT LEG



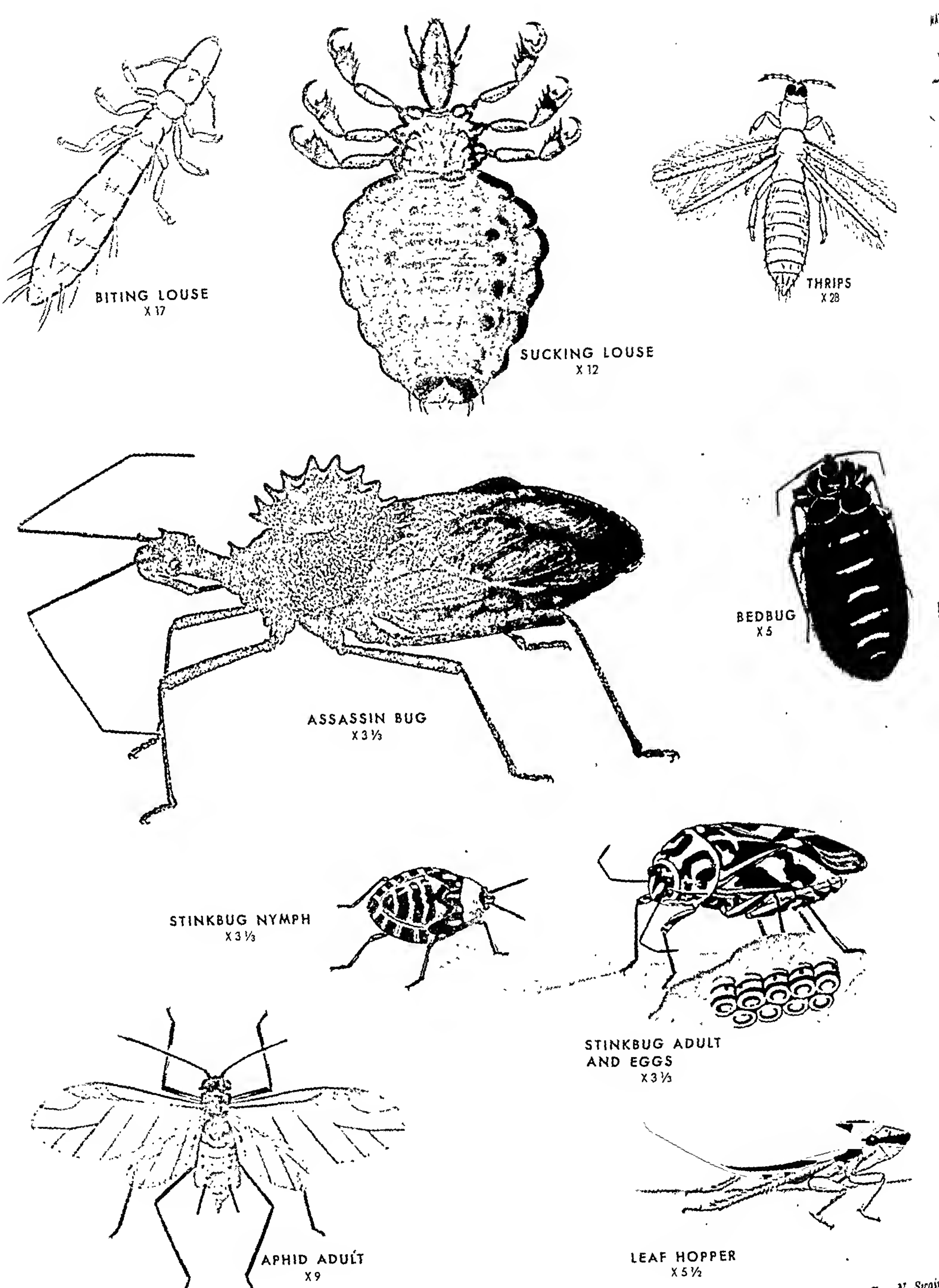
The legs of insects, like their mouth parts, are adapted to their way of living. Water insects use their legs for swimming. The hind legs of the worker honeybee are used primarily to collect pollen. Some predatory insects, like the ambush bug, have their forelegs modified as grasping organs to seize their prey. Jumpers and diggers also have special modifications.



Color paintings *By SuZan N. Swain*

SOME COMMON INSECTS—FROM PRIMITIVE TO COMPLEX

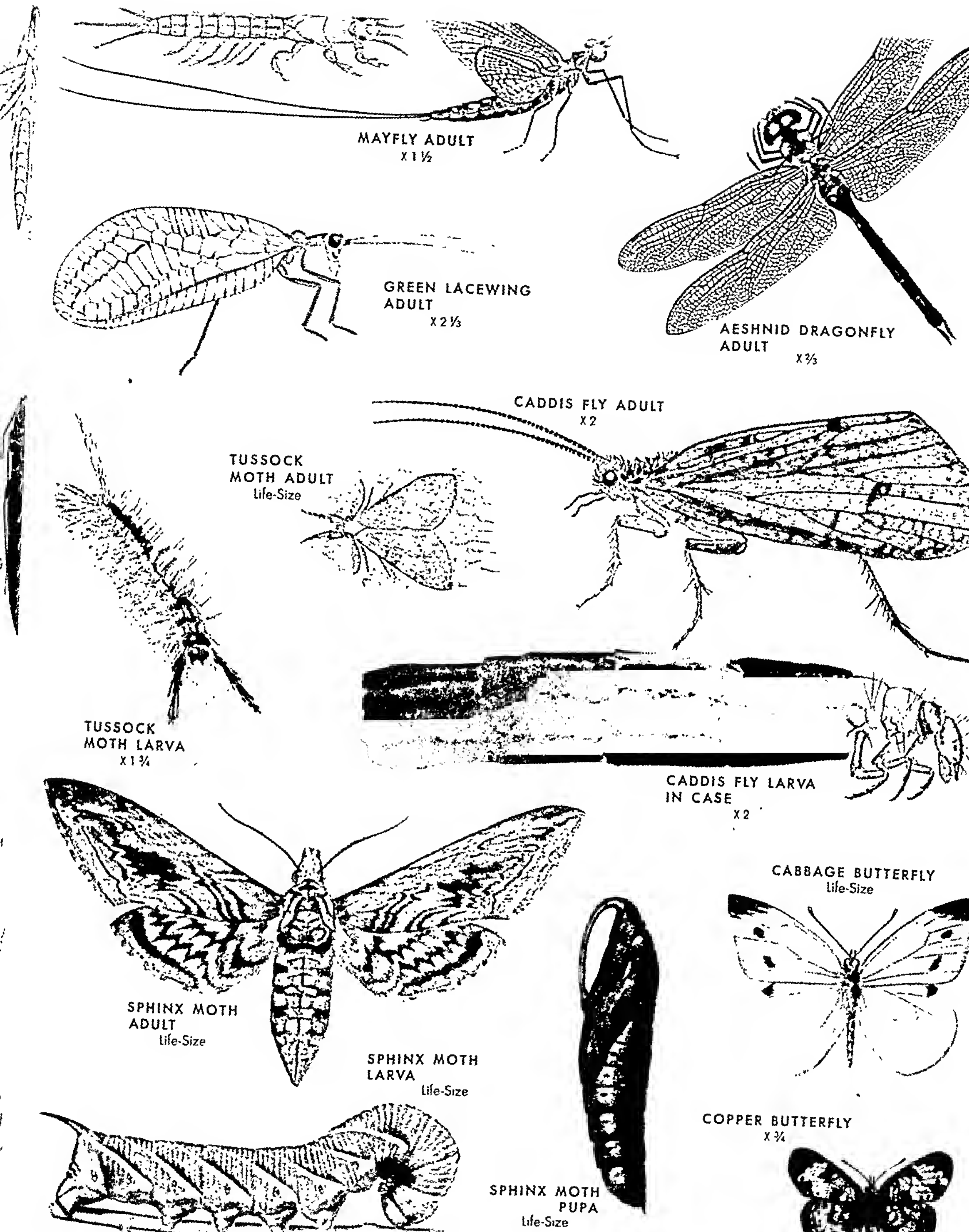
The silverfish and the springtail are among the most primitive of all insects. Termites, at the end of this series, are members of a highly complex caste society. The springtail is less than one-sixteenth of an inch long. The roach, the long-horned grasshopper, and the field cricket represent major families of the order Orthoptera. Earwigs are sometimes pests in houses and gardens as scavengers or plant eaters. The stonefly nymph lives in streams; the adult is a model for fishermen's lures.



Color paintings *By SuZan N. Swai*

SOME COMMON INSECTS—LICE AND BUGS

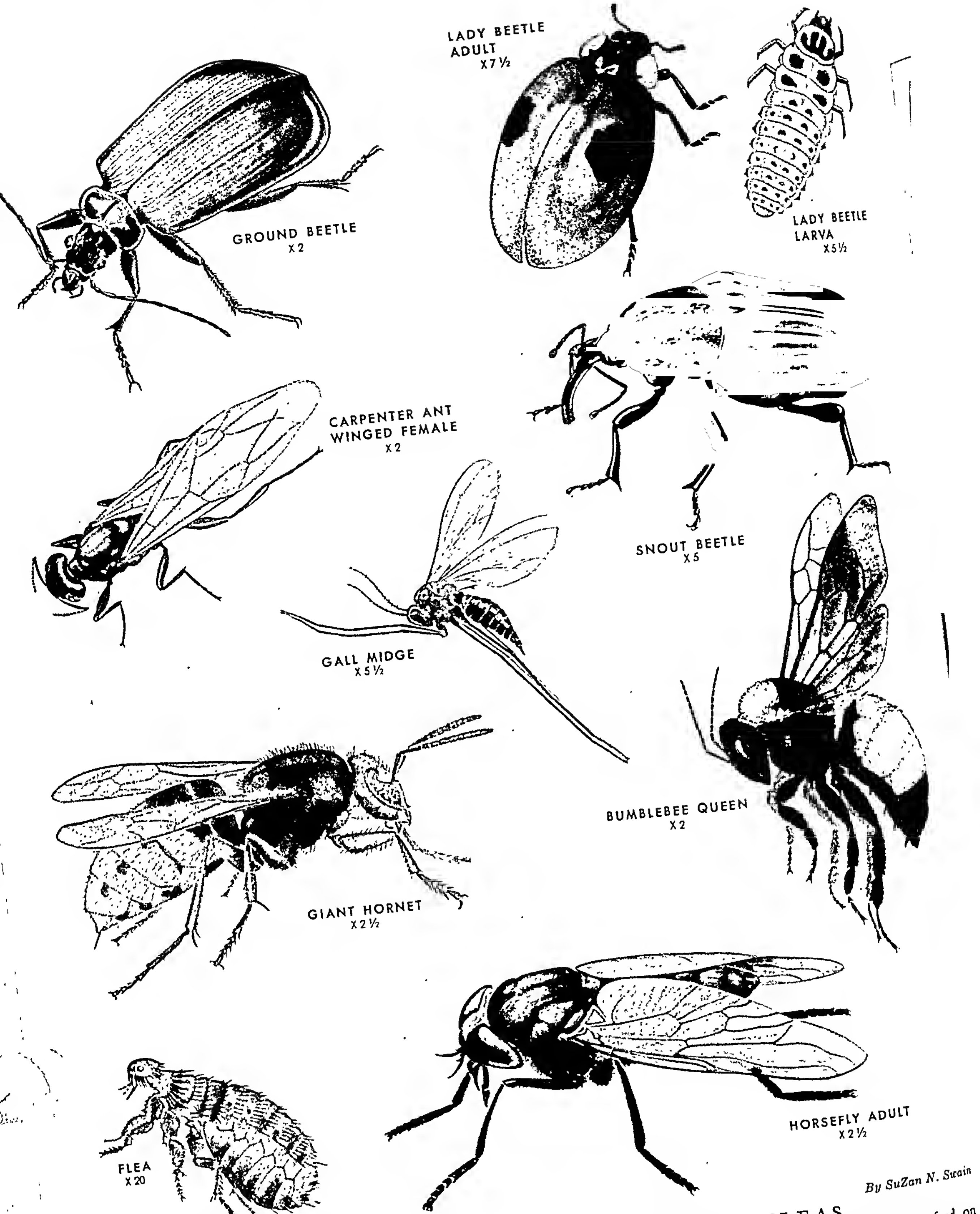
The biting louse (order Mallophaga) and the sucking louse (order Anoplura) are wingless, very small, flat-bodied insects external parasites on warm-blooded animals. Thrips (order Thysanoptera) are minute creatures, often found among th petals of flowers. Some are scavengers or predators, others feed on plants. The great bug order, Hemiptera, includes th assassin bug, bedbug, stinkbug, aphid, leaf hopper, and many others. All its members have piercing-sucking mouth part



Color paintings *By SuZan N. Swain*

SOME COMMON INSECTS—HARMFUL AND BENEFICIAL

The adult mayfly bears little resemblance to the nymph. The dragonfly destroys many mosquitoes. The green lacewing preys on aphids and other harmful insects. The larva of the caddis fly makes a shelter of pebbles, sticks, and leaves. It is a favorite food of fishes. The larvae of many moths and butterflies are serious pests of trees and cultivated fruits and vegetables. The tussock moth, sphinx moth, and cabbage and copper butterflies are only a few representatives of the order Lepidoptera.



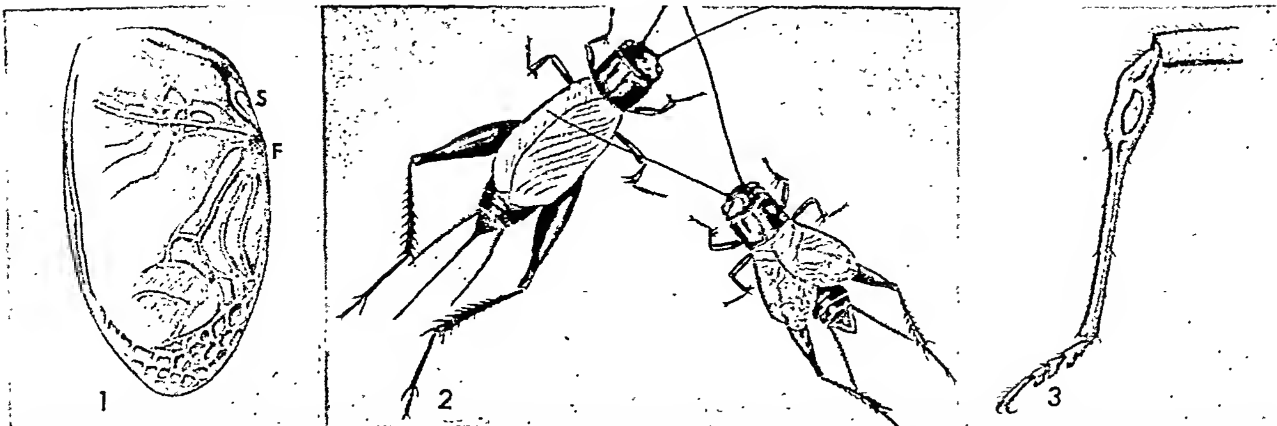
By SuZan N. Swain

Color paintings

SOME COMMON INSECTS—BEETLES TO FLEAS

Beetles belong to the largest order, Coleoptera. The ground beetle and the lady beetle are beneficial because they feed on injurious insects; but many snout beetles and the related seed weevils are among our most destructive pests. The carpenter ant, giant hornet, and bumblebee are social insects of the order Hymenoptera. The horsefly and gall midge are true flies (Diptera), characterized by having only one pair of wings. The flea (Siphonaptera) feeds on the blood of birds and mammals.

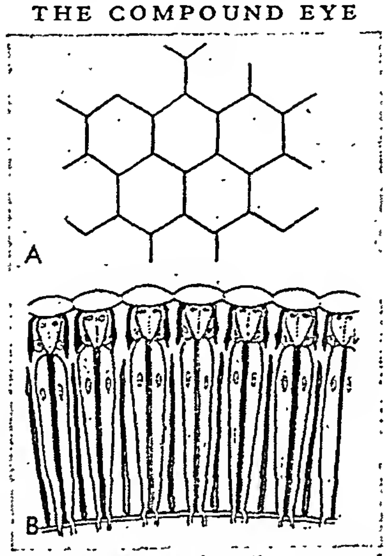
INSECT MUSICIANS SERENADE THE FEMALES



1. This is a picture of the under surface of the left fore wing of a male cricket. It shows a roughened spot, the scraper (S), and the file (F). The cricket chirps by rubbing the scraper of one wing against the file of the other. 2. A male cricket (lower right) is serenading the female. 3. This is the leg of a katydid, showing the "ear" located in the tibia.

that are prominent features on the heads of house flies and dragonflies; and the simple eyes (ocelli) which occur in twos and threes between the compound eyes. Each compound eye consists of many tiny seeing units. Although a single image is perceived, it is broken up into many small pictures. Insects, therefore, are said to have "mosaic" vision. The simple eyes are thought to be concerned chiefly with detecting motion. The senses of smell and of touch appear to be more important than sight.

THE COMPOUND EYE



The surface of an insect's compound eye (A) looks like this. Some of the hundreds of visual units (ommatidia) look like this (B) in cross-section.

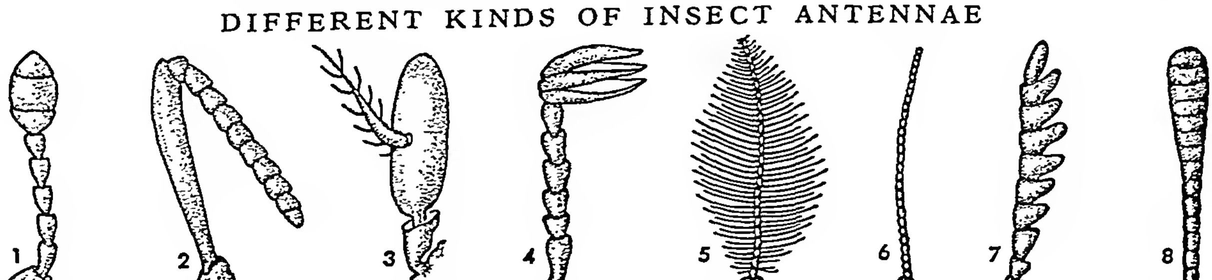
The antennae are very important, for organs of taste, touch, smell, and hearing may be located in them. Their loss usually leaves the owner in a shocked and helpless condition. Every insect has a single pair, but they differ considerably.

An insect walks on three legs at a time—the fore and hind leg of one side, balanced by the middle leg of the other side. Mouth parts and legs vary with the feeding habits and dwelling places of insects. The mouth of a biting insect such as the grasshopper consists of several parts. There is an upper lip, the labrum; a lower lip, the labium; and two pairs of jaws between them. The upper pair, called the mandibles, are designed for crushing food. The lower pair, the maxillae, seem to serve the purpose of holding food. On the maxillae and on the labium are feelerlike structures called palpi. The jaws work sideways, like a pair of tongs. The sucking types of mouth parts are all simply adaptations of form based on the biting type.

Hearing and Sound-Making

The hearing organs of insects are well developed in many species. The ears of katydids and crickets are located on the tibiae of the forelegs. They may also be located in the antennae and other parts of the body. The sounds made by insects are sometimes pleasing and sometimes irritating. The hum of the honeybee, the cicada's drone, the raspy song of the katydid, and the hungry whine of the female mosquito are familiar examples. Most of us like to hear the trill of the crickets, and in oriental countries crickets of various kinds are caged and marketed as singing pets. Some insect sounds are merely the result of wings in flight. Others are made by specialized organs to attract the opposite sex, communicate with other

DIFFERENT KINDS OF INSECT ANTENNAE



The antennae of insects are always jointed and take varied forms: (1) knobbed (many beetles); (2) elbowed (bees, ants, snout beetles); (3) aristate (housefly; referring to the bristlelike tip, or arista, projecting from the antenna); (4) scarab-type, composed of flat plates (June beetles); (5) double-combed (many moths); (6) threadlike (moths, roaches, caddis flies); (7) saw-toothed (many beetles); (8) clublike (butterflies).

members of a group, or frighten enemies. Roughened wing surfaces or mouth parts may be rubbed together. Legs may be scraped against wings or bodies. The male cicada has membranes within two concealed cavities below the thorax which it vibrates like drum heads. The female mosquito "sings" by means of vibrating bands stretched across the thoracic breathing organs. Even the young of some insects produce audible sounds. The grub of the besseybug, a common wood-boring beetle, has a filelike surface on the base of the middle leg which is scraped by the tiny hind leg that seems to have no other function.

Growth and Development

Insect development from egg to adult is most interesting, especially in insects which go through the complex changes called "complete metamorphosis." The manner of insect growth is quite different from our own because insect skeletons, unlike ours, completely enclose the body. Except for the pliable fold between the plates of chitin making up this external skeleton, there is no place where expansion can take place. The growing insect must therefore shed (molt) its covering from time to time. The new skin then hardens into another and larger covering. The young of all insects go through a varying number of such growth periods before maturity. Adult insects do not grow at all. Little flies do not grow into big flies. And, with the exception of the subadult stage of mayflies, only adults have functional wings.

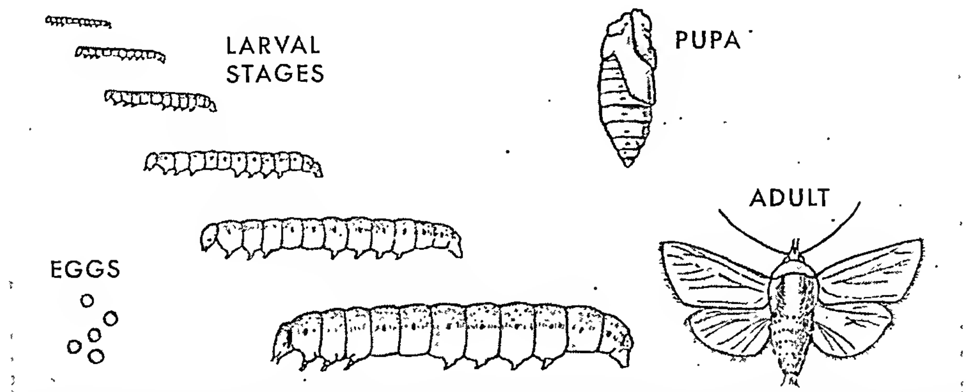
With a few exceptions, insects grow from eggs. Primitive species, such as springtails and silverfish, grow to maturity with little apparent change in outward appearance. The immature insects are called simply the "young." Immature grasshoppers, cicadas, locusts, crickets, and true bugs resemble the adult in many respects, but lack wings (*see* Grasshopper). Such young are called *nymphs* and are said to exhibit incomplete metamorphosis, or gradual development. A variation of gradual development occurs in the dragonfly and damsel fly order. The nymphs are aquatic and have a way of life quite unlike that of the parents (*see* Dragonfly).

Bees, beetles, butterflies, moths, and various other insects go through all the marvelous changes of metamorphosis. The young are called *larvae*, and in the inactive stages immediately preceding adulthood they are called *pupae*.

The larva hatches from the egg. Larvae often are mistaken for worms. They may be smooth-bodied creatures like the maggot of the bee or the fly, or they may be hairy like some caterpillars, or big and fierce-looking like the young of the tiger beetle. Larvae differ from the adults in many respects. Eyes, if present, are simple ocelli, not compound. The mouth parts may be of quite a different type than those of the adult. There may be structures which are not present at all in the adult. Caterpillars, for example, have legs called "prolegs" on the abdomen as well as on the thorax (*see* Caterpillars).

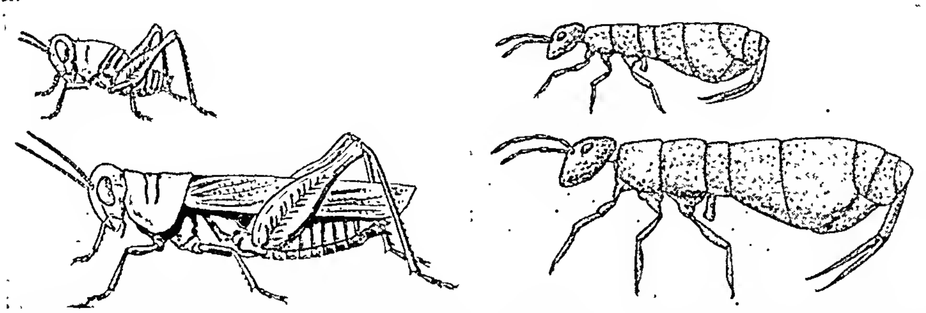
An insect is at its hungriest during its larval life, for that is its period of growth. The pupa is incapable of feeding, and very often the adult eats lightly, or in some cases not at all. The larval period also usually exceeds the adult period in length. It may last from several months to two or more years, while the adult may

COMPLETE METAMORPHOSIS OF A MOTH



The most advanced type of insect development is complete metamorphosis. The eggs hatch into larvae, which we know as caterpillars. The caterpillar grows by molting, or shedding its skin several times. It then changes into a pupa. Although it is inactive, great changes are taking place inside the pupa. Finally, the adult insect breaks out of the pupa shell, a very different creature from the larva.

INCOMPLETE METAMORPHOSIS AND DIRECT GROWTH

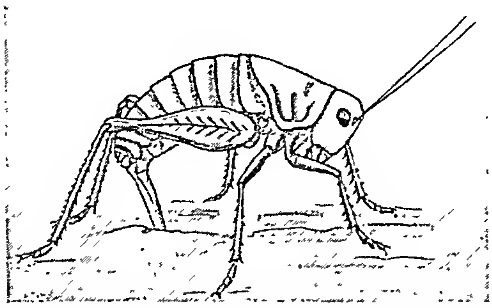


Grasshoppers (left) go through an "incomplete metamorphosis." The young, called a "nymph," looks very much like the adult, but its wings and certain other organs are undeveloped. Springtails (right) are among the most primitive insects. The young, when it hatches from the egg, differs from the adult only in size and sexual maturity. Its development is said to be "direct."

live only a few days or weeks. Some moths and butterflies live eight or nine months as adults.

The larva in its final stage must find a place in which to pupate, or turn into a pupa. Beetle larvae may hollow out a cell in the soil. Caterpillars may spin a silken cocoon about their bodies; or they may spin a band like a window-washer's belt to hold them against a twig; or they may simply hang themselves upside down from a pad of silk. The hairs of certain caterpillars may be used in the walls of their cocoons.

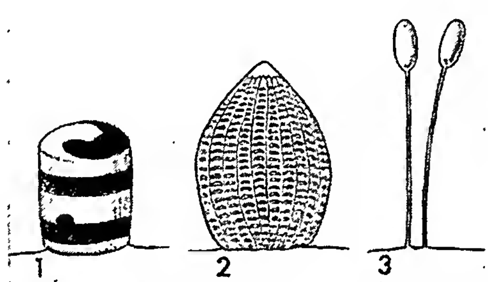
A MORMON CRICKET LAYING EGGS



The Mormon cricket inserts her ovipositor in soil to lay her eggs. They are laid singly or in small clusters. Although well hidden, they are dug out and eaten by birds and mice.

The pupal stage is a time of tissue rearrangement. Different kinds of mouth parts, legs, eyes, and perhaps breathing organs must replace those of the larva. What appears to be an almost lifeless period is really one of remarkable cellular activity. When the changes are completed the pupa (or *chrysalis* as it is called in the case of butterflies and moths) bursts out of its old skin. It has become for the first time a fully developed insect (*imago*) like its parents.

SOME BEAUTIFUL INSECT EGGS



Insect eggs, seen under the microscope, are beautifully colored and marked. These are (1) the harlequin bug; (2) the monarch butterfly; and (3) the golden-eyed lacewing.

There are exceptions to the egg stage, for the young of some insects are born alive. Such insects are called *viviparous* (Latin *vivus*, "alive," and *parere*, "bring forth"), to distinguish them from egg-laying insects, which are called *oviparous* (Latin *ovum*, "egg").

Plant lice or aphids have the curious habit of sometimes laying eggs and sometimes producing living young. These tiny green creatures also illustrate the practise, not uncommon among insects, in which the females bear young for many generations without the males. This is called *parthenogenesis* (from the Greek words meaning "virgin birth"). Some insects produce young in the larval or the pupal stages. This is known as *pedogenesis* or *paedogenesis* (meaning "birth from young").

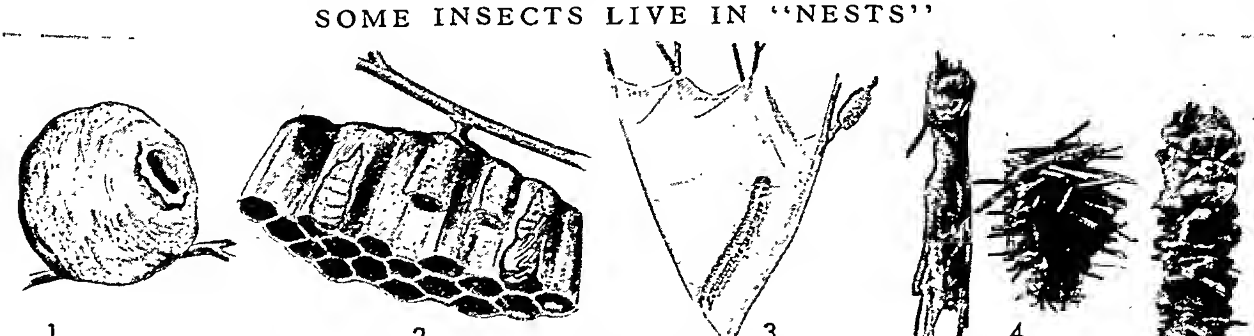
Egg-Laying and Care of Young

The chief duty of the adult insect is to reproduce its kind. Usually there are two sexes, but in some species, the white-fringed beetle, for example, males are unknown. In certain insects the sex of the offspring depends upon whether or not the egg has been fertilized. Among parasitic wasps, unmated females produce males only and mated ones produce the two sexes in about equal numbers. The queen honeybee can lay either fertilized or unfertilized eggs, as she chooses. The latter produce only drones. Very often male insects differ from the females in being smaller, more brightly colored, differently patterned, or strikingly armed with jaws or horns for offense or defense. The antennae of the male may be larger and more highly developed too, for it is by means of them that he finds the female.

The female adult instinctively places her eggs in a situation suitable for their hatching and for the development of the young. Parasitic wasps and flies place their eggs directly on the host. The horse botfly glues her eggs to the hairs of the horse where they will be licked off. Thus they are transferred to the horse's stomach, where the larvae live on the stomach lining. If a caterpillar feeds on only one species of plant, as the monarch butterfly on milkweed, then the egg from which it hatches is unerringly placed upon that plant.

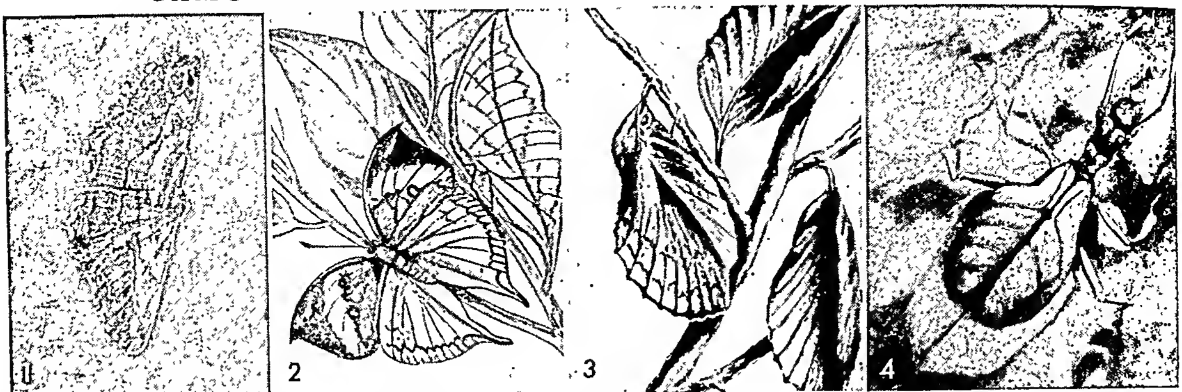
Insect eggs are often beautiful objects under the magnifying glass. The female sometimes goes to great lengths to conceal them. She may encase them in

SOME INSECTS LIVE IN "NESTS"



1. The clay jug of the potter wasp contains paralyzed caterpillars as food for the larva. 2. A larva and a pupa of a paper wasp may be seen in the opened cells of this hanging nest. 3. Tent caterpillars spin an unsightly web in the fork of branches. They come out of the web to feed, returning to it for protection from storm and heat. 4. In the larval stage, caddis flies cover their soft bodies with silken tubes to which they attach sand, twigs, or bits of stone.

CAMOUFLAGE AMONG THE SIX-FOOTED CREATURES



1. The willow beauty moth blends perfectly with the bark of a willow tree. 2. Two Indian leaf butterflies, one with wings open and the other with wings folded, can scarcely be distinguished from the leaves on which they are resting. 3. The lappet moth is another leaf imitator. 4. The walking leaf insect is one of the best mimics of all. It even fools its own kind who sometimes nip it by mistake. Camouflage among insects is far older than man's use of the device.

frothy secretions which dry to form a hard covering or may coat clusters of eggs with hairs or scales from her body. The eggs of many species are inserted into plant tissues by means of sawlike or spearlike ovipositors. Some of these egg punctures injure the plants. They make the fruit unsightly and worthless, split branches, cause galls, and, in some cases, spread plant diseases.

Nest building as an adult activity is confined chiefly to wasps, ants, and bees. Carpenter ants live in wooden galleries which they chew out of trees and fence posts. Mound-building ants construct great cities in the soil, with myriads of chambers and connecting passageways. The great paper apartment houses of the paper wasps and the honeycombs of the bees are most marvelous structures (*see* Ant; Bee; Wasps).

Nesting species must also feed their helpless larvae. Ants forage for food for their young and themselves. They raise fungus gardens and cultivate aphid "cows," whose liquid excrement or "honeydew" they eat. Ants feed their young daily. The mud dauber wasp lays its eggs in tubes of mud. It then stocks the tubes with paralyzed spiders and seals them. When the larvae hatch a sufficient food supply is at hand to last until they pupate.

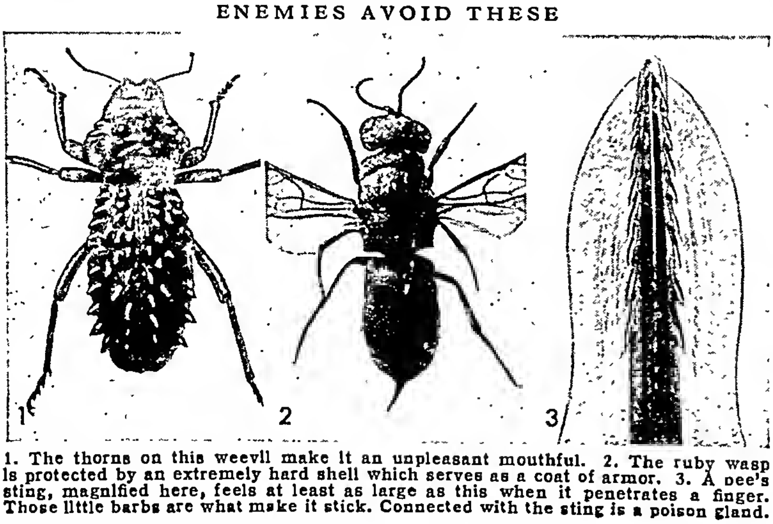
Protection from Enemies

We have said that an important law of insect life is to eat and avoid being eaten. To protect themselves from being devoured by their enemies, insects have developed a great many methods of defense. Flight, concealment, armor and weapons, and what we may call "frightfulness" or bluff are some of these methods. Everyone knows how difficult it is to catch or swat a fly. Quickness of motion is one defense. Certain insects are especially adapted for hiding. The flattened bodies of roaches and bedbugs enable them to scuttle out of sight into cracks where they cannot be reached.

The most interesting methods of concealment are *mimicry* and *protective colorations* (*see* Protective Coloration). The walking leaf insect imitates the color and shape of a leaf so well that its own brothers, who are strictly vegetarians, sometimes bite it by mistake. The walking stick looks like a slender twig. Certain moths blend so perfectly into the bark of the tree on which they rest that they cannot be distinguished from the tree. Some harmless insects imitate the shape and color of the stinging kind and so escape. Certain flies, for instance, mimic bees.

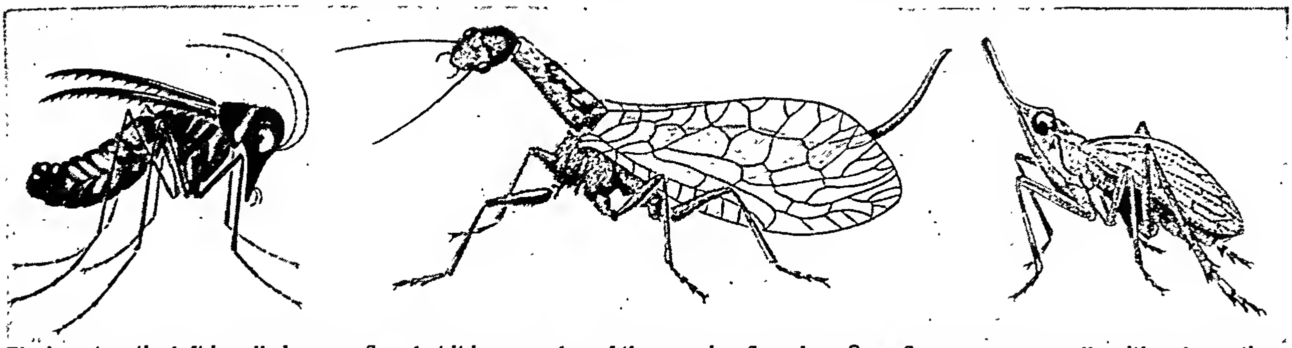
Armor and weapons are well developed in many insects. The tough, horny covering of the beetles amounts to a solid shell of armor. Sharp jaws and beaks, poison stings, and spines are effective. The larva of the mourning cloak butterfly, with its spiny coat, must be very unappetizing. The extreme hairiness of some caterpillars, such as the "woolly bears," makes birds and other predators avoid them. Stink glands repel attackers with unpleasant odors. The bombardier beetle fires

ENEMIES AVOID THESE



1. The thorns on this weevil make it an unpleasant mouthful. 2. The ruby wasp is protected by an extremely hard shell which serves as a coat of armor. 3. A bee's sting, magnified here, feels at least as large as this when it penetrates a finger. Those little barbs are what make it stick. Connected with the sting is a poison gland.

SOME STRANGE CITIZENS OF INSECT LAND



The insect on the left is called a snowflea, but it is a member of the scorpion fly order. Snowfleas are very small, with only vestiges of wings. On warm winter days they come out on the surface of the snow. The long-necked creature in the center is a snake fly, from the mountains of the West. The planthopper on the right has its head prolonged forward like a beak.

a little cannon it carries on its tail. It goes off with a "pop" and forms a tiny cloud of blinding gas which covers its escape. The puss moth caterpillar can also squirt out poison clouds, and locusts spit a brown fluid popularly known as "tobacco juice." Some insects taste so bad that birds and other enemies have learned not to eat them.

Many defenseless insects scare away their enemies by looking far more fearful than they actually are. And finally, an interesting defense mechanism is illustrated by the walking sticks. Weak joints in the legs permit the insect, if it is seized by the leg, to break off the captured part and escape. The amputated leg usually grows back again. This is known as *autotomy*.

Gall Makers

Everyone who walks observantly in woods and fields has noticed the abnormal growths on plants called *galls*. They may be very colorful, and often they have interesting or grotesque shapes. Galls are plant deformities caused by an irritation which stimulates the growth of protective tissue. Insects and mites are the chief irritating agents.

Most gall makers are aphids, psyllids, and scale insects of the order Hemiptera (all insects with piercing-sucking mouth parts), and beetles, moths, wasps, and flies. The Hemiptera insects feed on the plant juices. The others lay their eggs inside the plant tissues or the larvae bore into the plant. Galls apparently do not start to grow until the plant has been stimulated to excessive growth by the feeding of the sucking insects or by secretions from larvae.

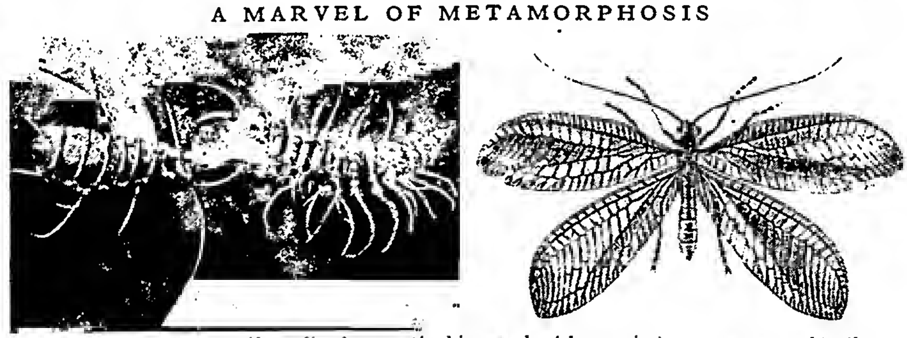
Two kinds of galls are produced—open and closed. The open galls, made by sucking insects such as aphids, simply grow up around the feeding insects, forming a shelter inside which they live and produce their young. Closed galls are made by chewing insects, which bite or gnaw their way into the tissues. No young are produced in closed galls.

In most instances, insect galls cause no serious injury to the plants, and the rapid cell growth means food for both insect and plant. An exception is the gall of the wheat jointworm (a tiny wasp), which weakens the stems of wheat and causes breakage and loss of the grain. The gallnuts on oak trees, caused by a gall wasp which lays its eggs in the twigs, are a source of tannin, used in tanning leather. Sumac galls and various others also yield tannic acid. Dyes and inks are obtained from certain galls. Some are even used as food by man and domesticated animals.

How Insects Spend the Winter

Insects may pass the winter in every stage of development, but each species does it in a certain way. Some butterflies winter as adults in caves or hollow trees. Others winter as pupae, young caterpillars, or eggs. An interesting study project for the winter months is to bring a shovelful of sod or a few handfuls of dead leaves and leaf mold into a warm room and watch the insects come to life.

A MARVEL OF METAMORPHOSIS



The ugly white larva at the left, shown attacking a plant louse, is known as an aphid lion. It is hard to believe that it will turn into the beautiful lacewing fly shown at the right, with its filmy green wings, iridescent red-gold eyes, and long, delicate antennae.

Even during the middle of winter some insects may come out of hibernation for brief periods of mild weather. Snow scorpion flies and springtails are often found on the surface of snow. Honeybees in well-protected hives maintain a temperature with their body heat which permits them to remain somewhat active and to feed on stored sweets. They will leave the hive when the temperature rises to about 55°F.

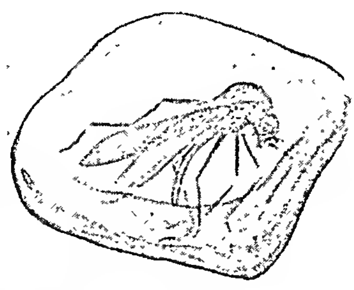
Extreme heat or drought brings about a period of inactivity corresponding to hibernation, called estivation. The eggs of mosquitoes and the nymphs and

adults of many aquatic insects remain without hatching or become dormant when ponds and marshes dry up. The monarch butterfly migrates southward each fall, and returns in the spring.

Insect Behavior

Insects do not have a reasoning intelligence. They are guided in everything they do by instinct and by mechanical reactions to external stimuli. Such reactions are called *tropisms*, from the Greek word *trope* meaning "a turning." All tropisms involve turning toward or away from a stimulus.

MOSQUITO IN AMBER

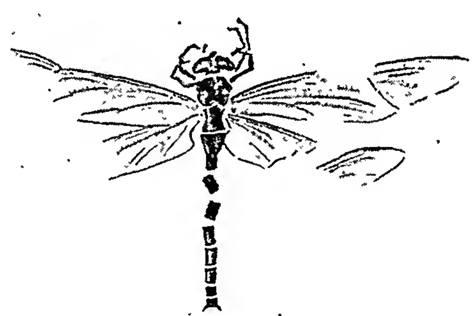


This mosquito, beautifully preserved in a bit of amber (petrified resin), was caught in the soft, sticky resin millions of years ago.

Reaction to chemical stimuli is called *chemotropism*. This often helps insects in finding places to lay their eggs. The carrion beetle, for example, lays its eggs on decayed meat, drawn to it apparently by odor. Butterflies and bees are attracted to flowers by perfume as well as by color. The scent glands of various insects probably help them in finding a mate. Insects also avoid certain substances by chemotropic reactions. This fact is used to repel pests. The clothes moth, for example, dislikes cedar and camphor; and plants are protected from pests by spraying with chemicals.

Many insects are attracted or repelled by light (*phototropism*). The moth that flies into a candle flame is a familiar example, and everyone has observed the insects swarming around an electric light at night. Some scientists believe that they orient themselves with their heads turned toward the light and are drawn into the source of the light in this way. Moths are attracted to artificial light, but avoid sunlight. Butterflies react in the opposite manner. Cockroaches and bedbugs scuttle into cracks when an electric light is turned on.

FOSSIL DAMSEL FLY



This is an imprint of an extinct damsel fly in Colorado shale. It is similar to the species of today. Coal-age dragonflies, relatives of this insect, had a two-foot wingspread.

Response to gravity (*geotropism*) may govern the way various boring insects react. *Thermotropism*, or attraction to heat, may draw parasites to their warm-blooded hosts. *Thigmotropism* is reaction to touch. Some insects avoid all contact with others; some thrive in close contact. The swarming of bees may be due to an attraction to one another's bodies. Attraction to water (*hydrotropism*), adjustment to currents of streams (*rheotropism*), and adjustment to wind and air currents (*anemotropism*) may explain the behavior of different kinds of insects.

Behavior of course is very complex and cannot be ascribed to any one stimulus or reaction. Egg laying is the result of a chain of responses set off by odor, moisture, heat, and other factors. As a rule, insects cannot adjust themselves to new conditions. A monarch butterfly larva, moved from a milkweed to some other plant, will starve to death. It cannot accept any other food. A wasp cannot repair any damage to its nest. It must build in a regular sequence. If it is interrupted it can either start in again at the beginning, or pick up where it left off, but it cannot go back and repair any omissions.

Ancient History of Insects

Insects appeared on earth long before mammals. The forests of the Coal Age contained cockroaches very similar to the household pests of today. The fossil remains of thousands of species have been found in coal, amber, and rock. Giant dragonflies with a wingspread of two feet, mayflies, and many others lived long ago. Possibly they were far more numerous than their descendants of today, for they had fewer enemies. There was a time when birds did not exist, and the insects that live on other insects had not yet appeared. Ancient insects were widely distributed over the earth, and some were almost as highly developed as the forms of today. They must, therefore, have been evolving from more primitive forms for millions of years before the earliest fossil records. The first insects probably evolved from primitive ringed worms. They were wingless, and developed directly, without metamorphosis, like the silverfish and springtails of today. Comparison of ancient species with present ones indicates which features are primitive and which are advanced.

Evolution from the primitive to modern complex species followed not a straight path, but a wandering, many-branched one, with many detours and dead ends, which makes the problem of classifying them an extremely difficult one.

How Insects Are Classified

Insects belong to the phylum *Arthropoda*, one of the chief divisions of the animal kingdom (*see* Animals). The word comes from two Greek words, *arthron* ("joint") and *podos* ("foot"), and refers to the jointed feet of these creatures. The arthropods include also the spiders, lobsters, crabs, and others. In this phylum, insects belong to the class *Insecta*. The class was formerly called *Hexapoda* ("six-footed"), and the word hexapod is retained as a synonym for insect.

Each insect, like every other animal and plant, has two scientific names. For example, the common housefly is *Musca domestica.* The first name always begins with a capital letter and tells us the genus to which the species *domestica* belongs. Usually the species or "kind" of insect is the smallest division of the classification system that concerns us. Sometimes species are further divided into subspecies or varieties on the basis of slight differences. The name or abbreviated name of the person who first described the insect follows the specific name in technical papers.

The thousands of insect genera (groups of species) in the entire world are divided among more than 900 families. These families, in turn, are grouped into 26 orders. The orders are the largest divisions of the class Insecta. The housefly, to summarize, is classified as follows: Kingdom, Animal; Phylum, Arthropoda; Class, Insecta (Hexapoda); Order, Diptera; Family, Muscidae; Genus, Musca; Species, domestica.

Following is a list of the principal insect orders. It is customary to list the orders as nearly as possible with the most primitive insects at the beginning, and the most highly developed at the end of the list. After the name of each order, its meaning is given. All derive from the Greek except Corrodentia, which is Latin. The suffix *ptera* means "wings"; *aptera,* "wingless"; "ura" is from *oura,* meaning "tail":

Thysanura (tassel tail), silverfish, bristletails, and allies; wingless, scaly, with three long bristles at end of body; no metamorphosis.

Collembola (glue bolt), springtails; tiny, wingless; jumping by means of a springlike appendage below abdomen; no metamorphosis.

Orthoptera (straight wings), roaches, grasshoppers, crickets, walking sticks, mantids, katydids, locusts, and their allies; forewings leathery; hind wings folded fanwise; this and the next ten orders have incomplete metamorphosis.

Dermaptera (skin wings), earwigs; forewings short; abdomen ending in a forcepslike appendage.

Plecoptera (plaited wings), stone flies; membranous wings folded flat over back; aquatic nymphs breathe with gills.

Isoptera (equal wings), termites; social insects with a caste system; resemble ants, but may be distinguished by broad "waist" and presence of cerci (appendages on the abdomen).

Corrodentia (gnawers), psocids, book lice, and allies; winged and wingless; unimportant economically except for book lice, which damage books and museum specimens.

Mallophaga (wool eaters), biting lice; small, flat, wingless; external parasites of birds and some other warm-blooded animals.

Anoplura (unarmed tail), sucking lice; wingless; external parasites of mammals, with sucking mouth parts for feeding on blood.

Thysanoptera (fringed wings), thrips; minute, typically with four narrow fringed wings; important pests of cultivated plants, spreading virus plant diseases.

Hemiptera (half wings), bugs, leafhoppers, scales, and allies; a diverse group, but having similar mouth parts of the sucking type; mostly four-winged; many species of economic importance; most of the carriers of plant virus diseases belong to this order.

Ephemeroptera (living but a day), mayflies; most night-flying, delicate, short-lived, with two or three long tail filaments; nymphs aquatic; adults do not feed.

Odontata (toothed), damsel flies and dragonflies; four wings long, narrow, almost equal; damsel flies fold wings together vertically when at rest, dragonflies keep them outstretched.

Neuroptera (nerve wings), lacewings, ant lions, snakeflies, and dobson flies; four large membranous wings of similar size, usually folded rooflike over the abdomen when at rest; this and the remaining orders have complete metamorphosis.

Mecoptera (long wings), scorpion flies; long-faced, narrow-winged insects; the tip of the abdomen in some males is carried over the back like a scorpion's tail.

Trichoptera (hair wings), caddis flies; adults mothlike but with longer antennae and uncoiled proboscis; larvae aquatic, many making fixed or portable cases in which they live and pupate.

Lepidoptera (scale wings), moths and butterflies; wings covered with scales; usually a coiled proboscis.

Coleoptera (sheath wings), beetles; forewings hard and veinless, meeting in a straight line over the abdomen; more than 250,000 species; the largest order of insects.

Strepsiptera (twisted wings), twisted-winged insects; the females are minute, wingless parasites on other insects.

Hymenoptera (membrane wings), wasps, ants, bees, and allies; four wings; contains the only social insects except the termites, and many useful parasites, predators, and pollinators; ovipositors in some females modified as a "sting."

Diptera (two wings), true flies; two wings, mouth parts quite variable; mosquitoes, punkies, and midges belong here; many flies pupate inside the last larval skin.

Siphonaptera (siphon wingless), fleas; tiny, wingless, jumping insects with narrow bodies adapted for moving between the hairs of the animals whose blood they suck.

Four obscure orders have been omitted from the above list. It is impossible to describe here even a few of the important families composing the twenty-two orders that are listed. Anyone can learn to recognize a goodly number of them by examining the books listed in the bibliography below. For example, a completely untrained person, given a mixed group of orthoptera insects, would have little difficulty in separating the roaches, walking sticks, mantids, short and long-horned grasshoppers, and crickets on the basis of obvious similarities. Each of these groups would represent a distinct family. Outside of knowing a few common species, most of us must be satisfied with identifying an insect by order or family.

Some Books on Insects

—Books for Younger Readers:

Bronson, W. S. Grasshopper Book (Harcourt, 1943).
Ditmars, R. L. Book of Insect Oddities (Lippincott, 1938).
Fabre, J. H. C. Insect World (Dodd, 1949).
Harpster, H. T. Insect World (Viking, 1947).
Matschat, C. H. American Butterflies and Moths (Random, 1942).
Pistorius, Anna. What Butterfly Is It? (Wilcox & Follett, 1949).
Teale, E. W. Boys' Book of Insects (Dutton, 1939)
Zim, H. S. and Cottam, Clarence. Insects (Simon & Schuster, 1951.)

—Books for Advanced Students and Teachers:

Comstock, J. H. Introduction to Entomology (Comstock Pub. Co. 1940).
Curran, C. H. Insects in Your Life (Sheridan, 1951.)
Duncan, C. D. and Pickwell, G. B. World of Insects (McGraw, 1939).
Essig, E. O. College Entomology (Macmillan, 1942).
Holland, W. J. Butterfly Book (Doubleday, 1931).
Jaques, H. E. How to Know the Insects (W. C. Brown, 1937).
Klots, A. B. Field Guide to the Butterflies (Houghton, 1950).
Lutz, F. E. Field Book of Insects (Putnam, 1935).
Metcalf, C. L. and Flint, W. P. Destructive and Useful Insects (McGraw, 1939).
Needham, J. G. Introducing Insects (Ronald, 1943).
Swain, R. B. Insect Guide (Doubleday, 1948).
Teale, E. W. Grassroot Jungles (Dodd, 1944).

Some useful pamphlets are:

How to Collect and Preserve Insects (American Museum of Natural History, New York City, N. Y.).
4-H Club Insect Manual (Misc. Pub. No. 318, U. S Dept. of Agriculture, Washington, D. C.).
Turtox Service Leaflets (General Biological Supply House, 761 East 69th Place, Chicago 37, Ill.).
Ward's Entomological Bulletin (Ward's Natural Science Establishment. Inc., Rochester, N. Y.).

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Insect Collecting and Mounting as a Hobby

These children are catching butterflies with a home-made net. The little girl is holding a killing bottle. Under the leaves on the ground, in brush heaps, and under the bark of trees they may find many other kinds of insects.

MAKING an insect collection, attractively mounted and displayed and correctly identified, is a delightful hobby. The first problem is to find the insects. They are everywhere. Look under boards and stones, inside rotten wood, under the loose bark of logs and stumps. With an insect net, sweep the tops of grass, weeds, and bushes and dredge in ponds and streams. On a warm summer evening dozens of species, including some that are difficult to find by day, may be captured at porch or street lights.

Watch the flowers that are attractive to insects, and catch the unwary ones. Sift or shake dry leaves over a white cloth. Great numbers of interesting species can be sifted from a square foot of sod. The beautiful scarabs of the dung beetle group are to be found in fresh manure in pastures. Other fine beetles occur only in the putrified flesh of dead animals. Decayed fruit contains interesting species.

A heavy sugar or molasses solution to which has been added a good quantity of fermented banana, peach, or grape pulp makes an effective bait for moths and certain other night-flying insects. Paint the syrupy mixture on tree trunks spotted along an easily followed woodland trail. Then visit the trees with flashlight and killing bottles at intervals during the night. "Sugaring," as this is called, can be an exciting summer-camp activity.

An outdoor light may be converted into a simple trap by suspending it over a large funnel which is resting on a killing bottle. Bits of meat in jars sunk to their rims in the soil will trap night-roving insects.

Nets are important tools. There are three types—sweeping or beating nets to collect insects hidden in vegetation; aerial nets for flying species; and water nets.

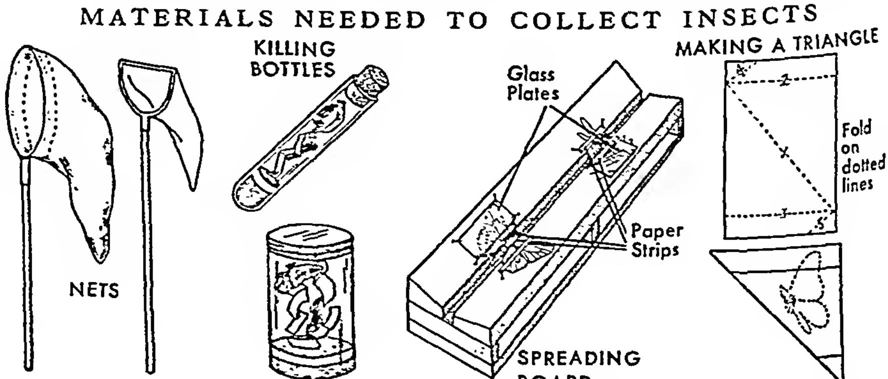
How to Kill Insects

Insects, of course, must be killed in order to preserve them. With the exception of moths and butterflies, most insects may be both killed and preserved by dropping them into a 70 per cent solution of alcohol. To prevent discoloration, soft-bodied larvae and pupae should first be killed in boiling water.

Moths, butterflies and other adult insects usually are killed in cyanide bottles. The potassium or sodium cyanide crystals and their fumes are deadly poisonous to humans and all kinds of animals. Cyanide bottles should be made only under adult supervision. Each should bear a POISON label. Plastic bottles are preferred to glass because they do not break. Satisfactory killing bottles can be made by saturating an inch layer of plaster of Paris with carbona or ethyl acetate. These are quite safe to use, but they must be strengthened from time to time. It is desirable to have at least two killing bottles. One should be used exclusively for moths and butterflies because the scales from their wings rub off easily and cling to and obscure the bodies of other insects that are placed with them.

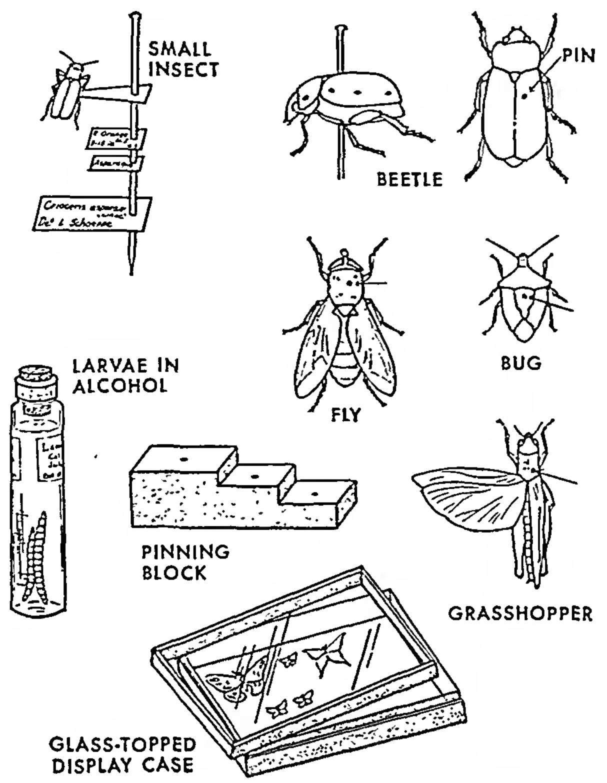
After the insects are dead, they should be removed from the killing bottle and either pinned at once or stored for future mounting. Moths and butterflies

MATERIALS NEEDED TO COLLECT INSECTS



The two most important articles for insect collecting are nets and killing bottles. The net usually has a 12-inch hoop and a 30- to 36-inch handle. The cloth bag should not be more than 24 inches deep. The net on the left is a "sweeping" net; that on the right is a dip net for water insects. Two killing bottles are needed, one with a wide mouth for moths and butterflies only. Triangles are necessary to protect moths and butterflies until they are ready for the spreading board. The drawings show how to fold a butterfly inside a triangle, and how to spread the wings on a board.

HOW TO PIN AND MOUNT INSECTS



Insects are mounted on pins provided by biological supply houses. The pins should be inserted in certain parts of the body, shown by dot and arrow. Notice how small insects are glued to the point of a triangle. The pinning block simplifies the task of placing insects at a uniform height on the pin.

may be stored in paper "triangles," which can be made easily by folding a rectangular piece of paper as shown in the figure on the opposite page; other insects may be placed between layers of cellucotton.

Mounting Insects

Most insects other than moths and butterflies may be preserved and displayed in labeled vials of 70 per cent alcohol. This is probably the best way to keep the soft-bodied, immature specimens. For more effective display and easier handling, adult insects of all but the smallest species are mounted by forcing a rust-proof pin of the proper size directly through the body of the insect. Species less than half an inch in length should be glued to the tips of cardboard triangles at the side of the thorax. The triangles are then mounted on pins (*see* illustrations). If dried insects are to be pinned, they must first be "relaxed" or their brittle appendages will break off. Any large, tightly covered crock or jar containing a deep layer of wet sand will serve as a relaxing chamber. A few drops of carbolic acid (phenol) should be added to the sand to prevent the growth of molds, and there should be a platform to keep the specimens from contact with the sand. One to three days in the relaxer will suffice for most insects.

The wings of butterflies, moths, dragonflies and damsel flies usually are spread on especially constructed boards and allowed to dry for about a week, after which they will retain that position.

The cork-bottomed display or storage boxes in which insects are pinned should be practically airtight to prevent mold. They should retain the fumes of paradichlorobenzene (PDB), the crystals of which can be purchased at any drugstore. These fumes also discourage museum pests such as book lice and dermestids (carpet beetles), which will devour insect specimens. Very attractive mounts may be made by embedding the insects in one of the newly developed "bioplastics." These materials may be obtained from biological supply houses, together with instructions for their use.

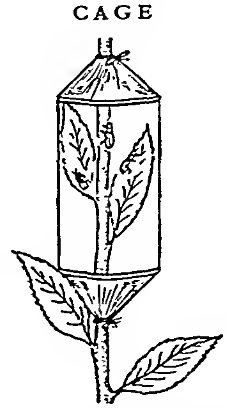
Most insects are so small that to see them properly we must use magnifying glasses and sometimes microscopes. A low-power hand lens enlarging objects 10 to 20 times will make the structures ordinarily used in classifying insects easily visible. Many insects, which without magnification appear quite without character, are objects of great beauty under the glass.

Collecting probably is more interesting to those who do it with a definite purpose or who specialize to some degree. One may wish to collect the insects of a single order, family, or genus, or the insects that live upon a certain plant or in a certain type of habitat. The sense of accomplishment comes more quickly to those who start a project with limited aims and a chance for successful completion.

While collecting insects is fun, it is also interesting to observe them alive. Observation in the field will teach us many things about insects, but to follow their life histories it usually is necessary to cage them. A celluloid cylinder cage with cloth ends which are closed by drawstrings, is shown on this page. This cage is especially good for sucking insects like leafhoppers and treehoppers. Caterpillars may be caged on the branches of their food plants with bags of cheesecloth or mosquito netting.

The lives of the honeybee and ant may be seen through the glass of observation hives and nests (*see* Nature Study). Terrariums will serve for many species, and, of course, aquariums will hold adults and nymphs of aquatic insects. It usually is a simple matter to rear moths and butterflies from collected cocoons and chrysalids if they are not permitted to dry out. A knowledge of food habits is the key to the successful rearing of most insects. Surprisingly little is known about the life histories of some of our commonest insects. Even the beginner may be able to observe things no one else has ever seen and, by keeping careful notes, may write up his observations for publication.

CELLULOID OBSERVATION CAGE



A cylinder of celluloid fastened around a plant stem makes a good observation cage.

Insect Pests That Cost Man Billions of Dollars Yearly

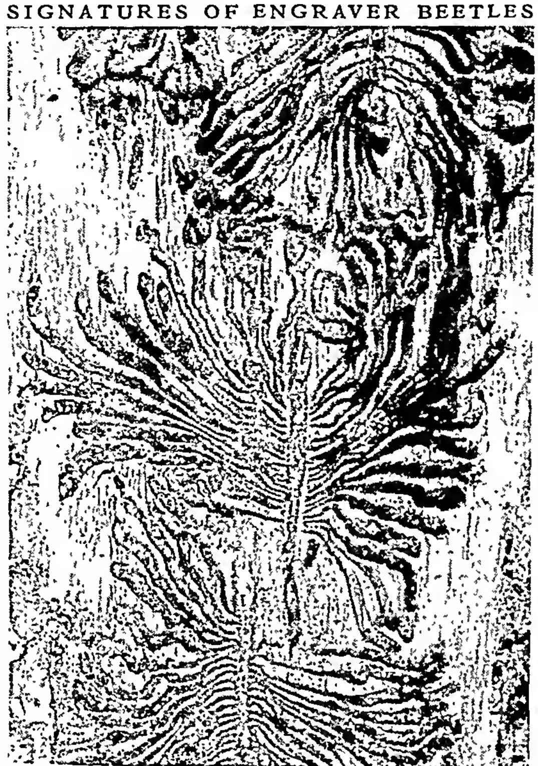
OUR INSECT enemies have killed more people and done more damage than mankind's worst wars. They have done this in past ages, and they still do so, in the course of their efforts to find food. Some feed upon us directly. We call these insects biters, but they are really sucking insects. Each one has a "beak" for piercing the skin and a sucking apparatus for drawing out the blood.

The mosquito is one of these biters. Most mosquitoes are just nuisances, but some spread diseases such as yellow fever and malaria (*see* Mosquito). Horseflies, stable flies, and tsetse flies likewise bite, and all carry disease. The housefly is not a biter, but it spreads disease in its own way (*see* Fly; Tsetse Fly).

The bedbug lives entirely on human blood. Lice and fleas prey on both animals and human beings. Like the common mosquitoes, these are usually annoying rather than dangerous.

One kind of flea, however, ranks among our most dangerous enemies. The article on Black Death tells how this flea helped kill a third of all the people in Europe within four years. The body louse too can be a deadly enemy. As it moves from person to person, in search of something to feed upon, it may carry the germs of typhus. (*See also* Parasites; Flea.)

SIGNATURES OF ENGRAVER BEETLES



The beetles that attacked this elm tree burrowed into the bark and tunneled upward, laying eggs in niches at the sides of the tunnels. When the eggs hatched, the grubs burrowed sideways, making the weird pattern you see here.

Other common insect pests invade our homes and attack our belongings. Most of them are chewing insects, and they do an immense amount of damage. Clothes moths cost the people of the United States about $20,000,000 a year. The females lay their eggs in furs, woolens, and materials made of hair. One female may lay as many as 160 eggs. After the eggs hatch, the larvae spend their caterpillar stage gorging themselves on the fur or fabric.

The fast-moving *silverfish*, or *fish moth*, attacks books and clothes. This is a small, wingless, scale-covered insect with two feelers and three long, fringed, tail-like appendages. It always tries to remain hidden and scurries for new cover if we disturb its hiding place. It attacks books to eat the sizing, or stiffening material, in the paper and bindings. It eats the starch out of clothing and curtains. Other enemies of furniture, food, and even the wood in houses are described in the articles on Beetles, Cockroach, and Termites.

Plant-Eating Pests

More than half of all insects feed on plants. Some of them do damage amounting to $100,000,000 a year in the forests of the United States (*see* Forests). Others attack shade trees in cities, towns, and villages; these cost the people of the United States $60,000,000 a

A EUROPEAN PEST ATTACKS AMERICA'S KING OF CROPS

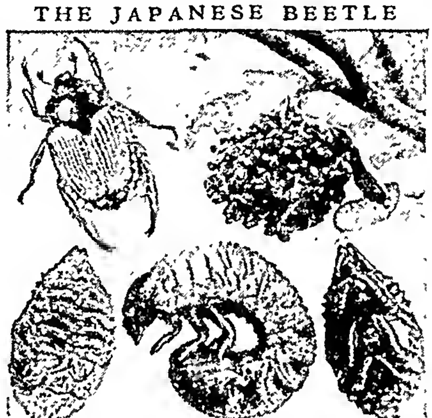
These are pictures of the European corn borer and the destruction it causes. In its adult stage this pest is a slender moth about three-quarters of an inch long. The upper circles in the picture show a female moth (left) and a male moth (right). The circles below show borers in the larval stage. This is the time when they work their havoc. At the left you see them feeding on ears of field corn; in the center is a damaged tassel bud; at the right they are tunneling in corn stalks. This pest came from southern Europe in 1909. Today it costs the people of the United States millions of dollars each year.

year. According to some estimates, farmers lose one-tenth of every crop to insects. The codlin moth destroys more than $13,000,000 worth of fruit each year by "worming its way" into apples and pears (*see* Codlin Moth). In addition fruitgrowers spend $17,000,000 a year fighting this pest. Insects which attack stored grain cost the nation more than $300,000,000 through the damage they do and the expense of controlling them.

The plant pests do their damage in many ways. Some insects chew into leaves, stems, buds, flowers, seeds, fruit, bark, wood, and roots. They are "free feeders" which move from plant to plant, eating and doing enormous damage as they go. The articles on Army Worm, Beetles, Cankerworm, Cutworm, Grasshopper, and June Bug tell about the worst of these free feeders. Other insects do their damage by sucking. They pierce plant tissue and draw out juices. Among these are the aphids, chinch bugs, cicadas, and scale insects.

Many other plant pests do their damage from inside the plants. Usually they do this when they are larvae, or grubs. Some "mine" their way through leaves. The larva spends its grub stage eating between the two outer, skinlike layers of leaves. This makes lines or blotches on the leaves. A "leaf roller" rolls all or part of a leaf into a shelter and spins silk to hold the roll together. Then it feeds on the leaf. Other kinds of pests tie several leaves together into a nest, usually called an "ugly nest."

THE JAPANESE BEETLE



The Japanese beetle, which was discovered in the United States in 1916, attacks almost every kind of plant and tree. Above at the right you see a group of beetles fairly enveloping an apple. At the left is an adult beetle. The lower pictures show the pupa and the larva.

Gall insects cause swellings to form on the buds, leaves, stems, flowers, bark, and roots of plants. Usually the female pierces the plant and lays an egg. The plant grows a swelling or gall around the egg or the grub when the egg hatches to protect itself. Oak galls, however, are valuable for the tannin they furnish (*see* Oak).

Perils of Upsetting the Balance of Nature

As long as a land is left in its natural state, insects do not multiply to an alarming extent. The balance of nature takes care of this. Every insect has natural enemies such as birds, and these keep the number of insects down.

But in America, settlers upset the balance of nature. They cut down forests and plowed up fields, driving birds away. They also introduced new vegetables, fruits, and grains from Europe. Many American insects flourished on these foods, escaped natural control, and became serious pests. The article on Potato Bug describes an outstanding example of this. (*See also* Nature Study, section "Balance of Nature"; Ecology, section "Control of Pests.")

Perhaps half the worst insect pests in the United States have come from other countries. These insects are particularly dangerous. Their new environment may not have the enemies which preyed upon them at home. Then they spread with startling rapidity.

Such pests have come to the United States in many ways and from many lands. The Argentine ant, enemy of field crops and stored foods, was a stowaway in a cargo which reached New Orleans in 1891. The cotton boll weevil entered Texas from Mexico in 1892. (*See* Weevils.) The alfalfa weevil arrived in Utah in 1902 in soil that stuck to imported plants. The corn borer came from southern Europe in 1909 in a shipment of broom corn. The oriental fruit moth, a serious pest of peaches, came from Japan in 1913 on cherry trees which the city of Tokyo presented to the city of Washington. In 1916 carloads of cotton seed from Mexico brought the pink bollworm. Ornamental trees from Japan reached New Jersey the same year, and brought the Japanese beetle. Three immigrants arrived in 1920: the satin moth in Massachusetts, the Asiatic beetle in Connecticut, and the Mexican bean beetle in Alabama.

The War Against Pests Begins

Until the middle of the 19th century Americans were helpless against the growing insect menace. Farmers had a saying for planting corn seed: "One for the squirrel, one for the crow, one for the cutworm, and one to grow." Then, in 1860, they learned that dusting potato plants with Paris green, an arsenical compound, would kill potato bugs. This discovery was our first success in controlling insect pests by scientific means.

In 1862 Congress provided for studying insect pests and other agricultural problems in the Morrill Act. This law also provided aid for the founding of state colleges to teach agriculture and mechanic arts (*see* Agriculture).

The Federal Plant Quarantine Act of 1912 began the fight against imported pests by providing for inspectors at ports of entry. These plant-pest policemen examine all seed, fruit, and plant products, even the baggage of passengers. Infected material is destroyed or thoroughly fumigated. (*See also* International Trade.) Airplane travel increased the danger of insect stowaways from other lands. Therefore inspectors examine and fumigate planes as soon as they arrive from foreign ports.

Ways of Fighting Pests

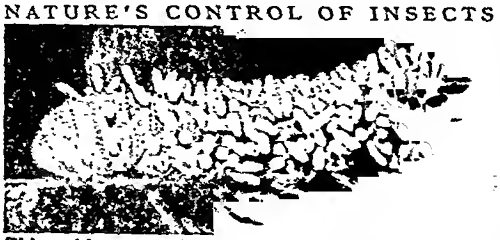
The ideal way to control insect pests is to kill them. Occasionally this can be done. In 1929 fruitgrowers of Florida discovered the Mediterranean fruit fly (a dangerous enemy of fruit in Europe) in their orchards. This threatened ruin to the fruit crop. State and federal entomologists united for battle. Congress granted $4,500,000 for the fight. The authorities put all Florida under quarantine. They supervised

destruction of all fruits and vegetables harboring the pest and of all abandoned or rundown orchards. Chemists developed new poison sprays. By the end of summer inspectors could not find a "Medfly" in Florida.

Usually, however, by the time a pest is recognized it has become too widespread for such total war. Then means must be found to check it.

The oldest means known is the use of chemical powders and sprays made from inorganic poisons. After the discovery that Paris green would kill potato bugs, chemists tried to find arsenical compounds that would poison plant-eating insects without hurting tender plants. Then they experimented with "contact poisons," since the "stomach poisons" would not kill sucking insects. (*See* Spraying.)

NATURE'S CONTROL OF INSECTS



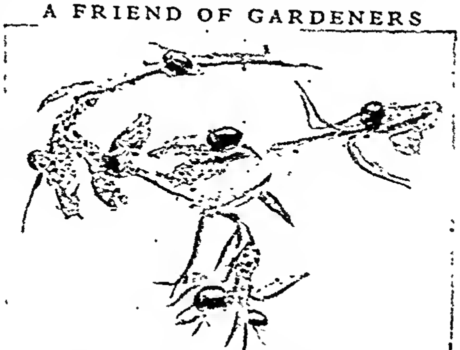
This sphinx caterpillar has been destroyed by ichneumon fly larvae that grew from eggs laid within its body. The white objects are cocoons spun by the larvae on the dead caterpillar.

The inorganic insecticides were all poisonous to people and domestic animals as well as to insects. Scientists therefore turned to organic compounds which would be poisonous to insects only.

The people of eastern Europe knew one such compound called "Persian insect powder" before 1800. It was *pyrethrum*, made from dried flower heads of a daisylike flower called pyrethrum, of the chrysanthemum genus. About 1909 the English found another compound, *rotenone*. It came from the roots of several woody tropical plants. The best sources belong to the bean family of plants. They are *derris* of Malaya and the East Indies and *lonchocarpus* (also called cubé and timbo) of South America.

Although these were not sure killers of insects, they were not poisonous to people or to most domestic animals. The problem was to improve them as insect killers. In 1924 chemists discovered the chemical nature of the poisonous factors in pyrethrum and rotenone. Soon they learned how each poison works.

A FRIEND OF GARDENERS



Encourage the ladybugs and lacewing flies to visit your garden. They and their larvae greedily devour the destructive plant lice, but do no harm to the plants.

Pyrethrum is a "contact poison." Its touch paralyzes and kills. The powder or an extract in mineral oil makes an efficient spray for killing flies, mosquitoes, cockroaches, bedbugs, and ants in homes, farm buildings, and institutions. A solution in water works well as a plant spray. The powder is used to control insects in flour mills and poultry houses and to dust garden crops.

Rotenone kills insects when it touches them or when they eat it. Gardeners use a powder of 0.5 to 1 per cent rotenone in finely ground clay or talc to kill pea aphids, cabbage worms, and other pests of truck gardens. Rotenone extract in kerosene is a good fly spray. A mixture of cubé extract and pyrethrum in mineral oil makes an excellent household spray. In 1942 a Swiss firm asked the United States Department of Agriculture to consider a compound which a German chemistry student named Othmar Zeidler had created in 1874. It had remained just a formula in a chemical journal until 1939. Then a Swiss chemist named Paul Müller discovered that it killed insects.

This new insect killer became known as DDT. The initials come from the chemical name, *d*ichloro*d*iphenyl-*t*richloroethane. It can be made from chlorobenzene and chloral hydrate ("knockout drops"). It penetrates the chitin of an insect's body or feet and stimulates, then paralyzes, the nervous system. During the second World War, DDT prevented epidemics of typhus in North Africa and Italy. It could do so because typhus is carried from person to person by the body louse. To kill this carrier (or *vector*, as scientists call such a carrier), army workers mixed DDT with talcum and dusted it on more than two million people and their clothing. It gave a month's protection against lice even though clothing was laundered. DDT is used indoors in a kerosene spray as well as in dusting powder. When it is sprayed on walls, it remains deadly to insects for several months. It may do more harm than good outdoors. There it kills many insects that benefit man. It is most effective against soft-bodied insects. It does not seem to be poisonous to human beings, but it may make the skin break out or cause nervousness.

Chemists at the Naval Medical Research Institute developed another killer (NMRI 448) from benzene and cyclohexane. This kills insects for about 30 hours after being sprayed indoors. It repels insects for two weeks when sprayed or smeared on people or cattle.

The Department of Agriculture developed an aerosol "bomb" for applying insecticides indoors. An aerosol is a suspension of fine particles in gas. The "bomb" is a small can containing insecticide suspended in liquefied gas under pressure. Release of a valve propels this into the air, where it floats like a fine mist until the gas evaporates. Aerosol bombs usually contain pyrethrum and DDT suspended in freon.

Other Methods of Attack

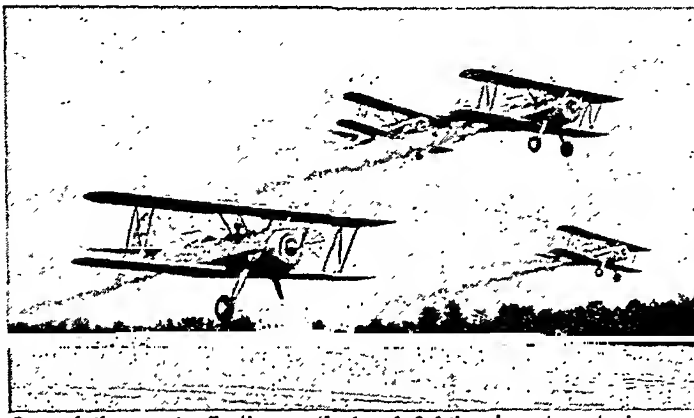
Sprays and powders for farm and garden pests are expensive and troublesome to use, and insects gradually develop a resistance to them. Other means of attack consist of cultivating land in order to defeat the pests. These are most valuable for field

crops which cover a large area and have a low value an acre. "Clean culture" is one of these methods. It consists of removing all old plants after harvest and depriving pests and their eggs of refuge through the winter. Another is changing the time of planting. If a farmer can sow his winter wheat late enough, it will not come up until the fall flight of the Hessian fly is over. Then his crop will escape serious trouble from this pest. Sometimes investigators develop tough varieties of crops which hold their own against insect pests. They have found strains of corn which resist the European corn borer, wireworm, and chinch bug (*see* Corn).

Poison baits control some insects. Cutworms, which hide in the soil by day but come out at night to feed, will eat poisoned bran spread in the field (*see* Cutworm). Poison bait is also effective against grasshoppers and locusts.

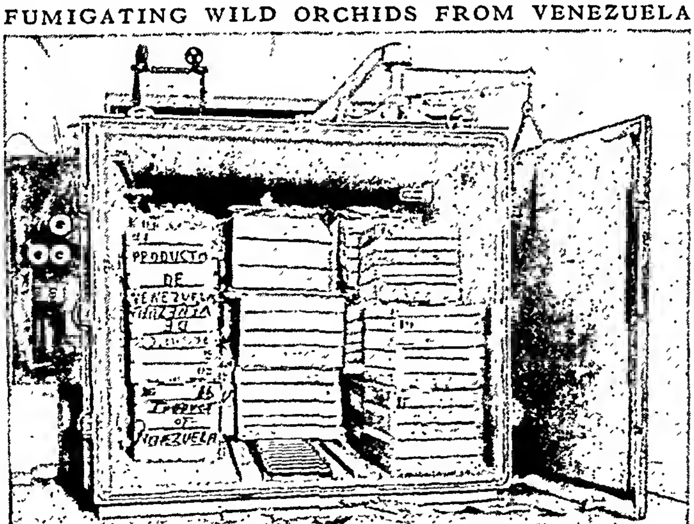
Often the best method, especially for imported pests, is *biological control.* This consists of restoring the balance of nature by introducing one or more insect enemies to prey on the pests. The article on Scale Insects tells how fruitgrowers in California fought the cottony-cushion scale with ladybugs from the scale's homeland, Australia. The United States Bureau of Entomology and Plant Quarantine has introduced enemies to fight the gipsy and browntail moths, the Japanese beetle, the European corn borer, and other pests. Whatever the methods used, the war upon insect pests must be a strategic war in which no quarter is given and no armistice declared.

AN AIRPLANE ATTACK ON INSECT PESTS



One of the most effective methods of fighting insect pests is crop-dusting by airplane. Low-flying planes lay a dense cloud of insect-killing powder over the infested fields. The method is also used to spray forest trees that are being attacked.

FUMIGATING WILD ORCHIDS FROM VENEZUELA



To prevent the introduction of any dangerous tropical insects, these boxes of wild orchids from Venezuela are about to be fumigated. The work is done by the Federal Bureau of Entomology and Plant Quarantine.

INSTALLMENT BUYING. Most automobiles are now bought on the installment plan. The buyer pays down only part of the price and pays the balance in monthly installments. Real estate, furniture, household appliances, radios, and jewelry are also bought largely on time payments. The total volume of such sales has been variously estimated at from one-twentieth to one-seventh of all the nation's retail business.

Economists see both advantages and disadvantages in this form of consumer credit. Millions of consumers enjoy comforts and luxuries they never could possess if they had to wait until they could pay the price in one sum. Sellers can get mass distribution for expensive articles instead of having their market limited to the comparatively rich. The automobile business never could have become as big as it is without installment selling.

On the other hand, extravagant buyers may tie up too much income in meeting installments. If illness or unemployment cuts their income, they may lose both the articles and the money they have paid. Reputable merchants, therefore, investigate the financial standing of buyers and make sure they have income enough to make such purchases safely.

Moreover, installment buying increases the cost of goods. Since the seller must get interest on the money owed him, and must also maintain a collecting organization, a *carrying charge* is added to the cash price. In many lines of business, special *finance companies* take over the buyer's obligation from the retail seller and carry the transaction themselves. Many installment sales are *conditional;* that is, the article remains the property of the seller until all payments have been made. Many states require use of a "uniform conditional sales contract" to prevent unfair terms.

In August 1941, President F. D. Roosevelt issued an executive order authorizing the Board of Governors of the Federal Reserve System to regulate installment buying. The Board in turn issued an order known as Regulation W which became effective Sept. 1, 1941. This set a minimum down payment for installment purchases and limited the time during which the balance was to be paid. One purpose of such control was to decrease consumer competition for scarce goods.

At the same time, the reduction of consumer buying power helped to keep prices down.

The federal government continued to control installment buying throughout World War II. In August 1947 controls were dropped. Regulation W was partially reinstated in September 1948. Controls were again relaxed as manufacturers turned out an increasing stream of goods that were once in short supply. In 1950 increased defense spending produced another inflation threat so the Federal Reserve Board ordered new restrictions on installment buying. These were eased again in 1952.

Records of installment sales have been found on clay tablets that have been preserved from the days of ancient Babylonia. This form of consumer credit did not come into wide use, however, until the 1800's. Furniture dealers adopted it in the early years of that century. Installment buying was applied to sewing machines about 1850 and to pianos about 1875. In the present century installment credit has spread to goods and services of almost every kind and is common in practically every modern country. In England installment buying is called hire purchase. (*See also* Credit; Thrift.)

PROTECTION *against* LOSSES *from* MISFORTUNE

All the Members of a Family Listen Intently as an Agent Explains an Insurance Policy

INSURANCE. Everyone encounters dangers and risks in daily life. The father of a family may die suddenly, leaving his widow and children penniless. A family's home or store may burn down. A person may be injured in an automobile accident and spend weeks in a hospital. Others may live beyond the time when they can earn an income and find themselves without money to pay for the necessities of life.

Insurance provides money to help people in these situations. This can be done because misfortunes, on the average, happen to about the same number of people year after year. The amount of property damage in any given year can also be accurately estimated. By sharing these losses groups of people can provide for mutual protection. Each one pays a yearly sum based on the average rate of loss. The total paid by the group exceeds the total average loss for the group. When any member suffers a loss, a definite sum of money in compensation is paid to the insured or to his *beneficiary* (person designated by the insured to receive the benefit).

No matter what the type of insurance, the possible misfortune or loss is called the *risk*. The payment made for the protection is called the *premium*. The amount of the premium to cover the risk is calculated by an *actuary*. The money (or investments convertible to money) on hand to meet the losses paid by the insurance company is called the *reserve*. A person or company who assumes part or all of a risk is known as the *underwriter*.

Most insurance is sold by agents (salesmen and saleswomen) who call on prospective purchasers.

Agents are high-school or college graduates. They usually receive special training from their companies.

How Life Insurance Works

ONE OF the most important forms of insurance for families is *life insurance*. This provides a single sum of money or periodic payments upon the death of the insured member of the family. Life insurance is underwritten by both stock and mutual companies.

A *stock company* has both stockholders and policyholders. The stockholders invest money and collect dividends if the company profits. The policyholders receive protection. In a *mutual company*, the policyholders are the stockholders. They own the company and the management is responsible to them.

Life insurance companies sell two basic types of policies—participating and nonparticipating. Mutual companies sell only the participating type. Some stock companies sell both kinds of policies and some of them handle only the nonparticipating kind.

For a *participating policy*, the premium rate is fixed at an amount somewhat greater than the company expects to pay out under normal conditions. The policyholder then receives a refund, in the form of a *dividend*, based on actual operating experience plus an estimate of future trends. The dividend represents that portion of the premium not needed for present and future benefit payments. A dividend is usually available after premiums for the first two or three years have been paid. They are generally paid annually thereafter. Deducting this yearly dividend from the regular *gross premium* gives the policyholder his yearly *net cost*.

In a *nonparticipating policy*, the premium rate is fixed as closely as possible to what the company expects to pay for the cost of providing insurance. This premium rate then becomes the net cost to the policyholder. When a life insurance policy is purchased, there is no way of foretelling which type of policy will cost less in the long run.

All life insurance premiums are based on the *life expectancy* of the person insured. While no one can say when a person 30 years old will die, it is known that on the average American men will live to be about 68 years old, or 38 years more. Life expectancies vary with age, sex, place of residence, occupation, and other factors. Actuaries, experts in statistical probability, constantly study the relationship of deaths to all these matters (called the *mortality experience*). Premium rates are fixed according to these findings for the kind of protection provided.

Ordinary, Industrial, and Group Life Insurance

Ordinary life insurance is the oldest form of protection. It is usually issued in units of $1,000 or more and is designed to furnish personal and business insurance as a protection against loss of earning power. In this type of insurance, premiums are payable annually, semiannually, quarterly, or monthly.

Industrial life insurance was introduced into the United States in 1875. The unit of purchase is generally the amount of premium paid (based on 5-cent units per week) rather than the amount of insurance. The amount of life insurance is usually for less than $1,000. This type of life insurance was created to supply the industrial population with insurance similar to ordinary life but in smaller policies and with smaller premium payments. These payments are frequently collected weekly at the home.

Group life insurance originated in 1911. Under this form of insurance, a number of people, usually the employees of a business organization or members of a labor union, are insured without medical examination. A master contract is issued to the employer or to the union. Each insured employee receives a certificate giving the amount of his insurance, the name of his selected beneficiary, and his various rights and benefits under the policy. One of these rights is the conversion clause which permits the insured to buy an individual type of policy without evidence of "insurability" if he leaves his employer. Group life insurance provides payment at the death of the insured. No other values are provided. The employer and employees may share the cost or the employer may pay the entire cost. If the employee shares the cost, his portion is usually deducted from his salary, or wages.

Types of Ordinary Life Insurance

The most common form of life insurance policy is called *straight life* or *whole life*. In this type of policy the company agrees to pay a set sum at the death of the insured. The insured, in return, pays a fixed annual premium for as long as he lives or as long as he desires to keep the policy fully in force. The premium may be paid annually, semiannually, quarterly, or monthly.

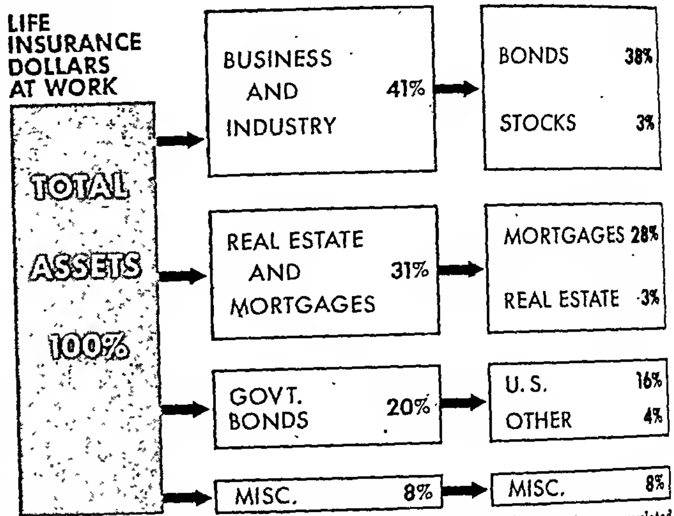
Limited pay life policies also provide lifetime protection but they limit the number of premium payments that are to be made. The payments are for 10,

HOW TO BUY LIFE INSURANCE

1. Do not wait to have insurance sold to you. Get the fullest information and then buy what suits your needs. A good life insurance agent will give valuable help in selecting the right types of policies for you.
2. Use insurance to protect your dependents in the event of your premature death. Use systematic savings to prepare for your future retirement. Investigate thoroughly before combining these two objectives into a single contract.
3. Place your insurance primarily on the family breadwinner.
4. Remember that you get more in ordinary life insurance than in industrial insurance.
5. If the company you work for offers group insurance, take all the plan allows you.
6. In arranging your insurance program do not overlook benefits payable under the Social Security Act.
7. If you have a loan on a policy or need a new loan, investigate the possibility of refinancing or borrowing through a bank.
8. Do not buy more insurance than you can pay for. After you have purchased it, keep it in force as long as you need it. Do not buy a policy, allow it to lapse, and then later buy another policy.

20, or 30 years or to a certain age, usually 60, 65, or 85, according to the buyer's choice when he selects the policy. Because the premium paying period is limited, the premium rate is necessarily higher than for a straight life policy. The higher premium, however, builds higher cash values than are available in a straight life policy.

Life insurance for a limited time, usually 1, 5, 10, 15, or 20 or more years, is called *term* insurance. During the selected term the insured pays only a portion of the ordinary premium. If he dies before the end of the term his beneficiary receives the full amount of insurance. If he lives and allows the policy to expire, he receives no benefits. Some term policies are convertible to permanent insurance. Others are not convertible but can be renewed. Some term policies are both convertible and renewable. None have cash or loan values.



This chart shows three great fields of investment for the assets accumulated by life insurance companies. Returns on these investments help lower insurance costs. The total amount of assets is about 70 billion dollars.

Endowment policies are a special form in which the insurance is payable to the insured person at the end of a selected period (often 20 or 30 years) or to the beneficiary if the insured person should die earlier. Premiums may be paid during the whole period or during a shorter term of years if desired.

Life Insurance Purposes and Values

These types of life insurance policies—straight life (including limited pay life), term, and endowment—are the basis for many variations of policies. Each kind of policy is developed to meet the needs of individuals and families. Some of the general needs are to provide: the last expenses of the insured, income during a readjustment period, income during a period when children are growing up, life income for the widow, mortgage cancellation, educational funds, and special bequests.

In addition, ordinary life insurance is frequently used in business to insure the lives of executives and other key personnel for the benefit of the business. In small corporations and partnerships, all part owners are often insured. This makes it possible to pay the family promptly a prearranged price for an interest in the business when a part owner dies. Such protection avoids delay in settlement or even liquidation of the business.

Except for term insurance, all types of life insurance policies provide values to a policyholder who stops paying premiums after two or three years. The longer the premiums are paid, the greater such values will be. These values, called *nonforfeiture values*, are of three kinds:

Cash or loan value. The cash value is the amount of money that will be paid to a policyholder if and when he stops paying premiums. It is a value guaranteed in his contract by law. Often it is more advisable to borrow part or all the cash value than to discontinue the policy. Such a loan may meet the temporary need for money and yet enable the policyholder to keep his insurance in force.

Extended term insurance. Instead of surrendering the policy or borrowing against it, the policyholder may choose extended term insurance. This gives continued protection for the full face amount of the policy (less any outstanding loan) for a specific period of time.

Reduced paid-up insurance. When a policyholder wants or needs to stop paying premiums he may change to reduced paid-up insurance. This will give protection for life without further premium payments, but the insurance is reduced in amount.

Income Provisions of Life Insurance

Almost all ordinary-type life insurance policies are payable in a lump sum. There are, however, three optional methods of settlement usually available:

Interest payments. The company holds the policy proceeds and pays interest at a guaranteed rate.

Installment payments. The company will make regular payments of equal amounts until the fund is used up. Interest on the unpaid portion of the funds extends the periodic payments beyond the face value.

Life income or annuity payments. The company will make a regular payment to the insured or his beneficiary for as long as he lives. Sometimes this payment can be arranged to provide income for two people (husband and wife) as long as either lives.

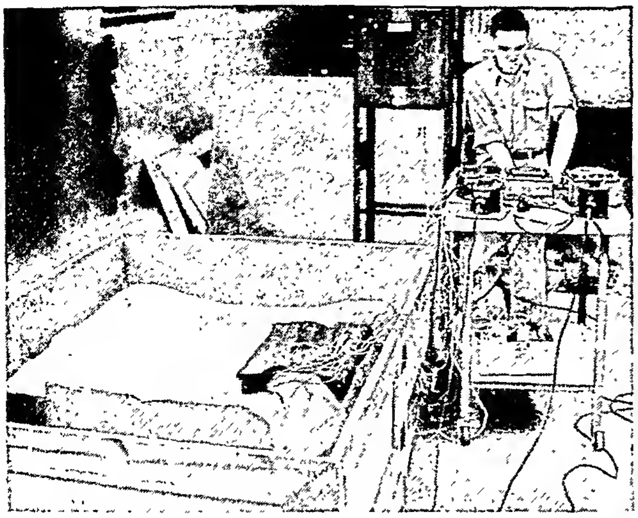
While life insurance is designed to furnish protection for dependents, *annuities* are designed to furnish income for old age. Thus the two contracts complement each other. Some annuities include an insurance element giving the protection of life insurance.

In one popular type of annuity contract, the company guarantees the purchaser or others a fixed income after the purchaser reaches a certain age. Very often this age is 65. In return, the purchaser pays either a lump sum or annual installments until the prescribed age is reached.

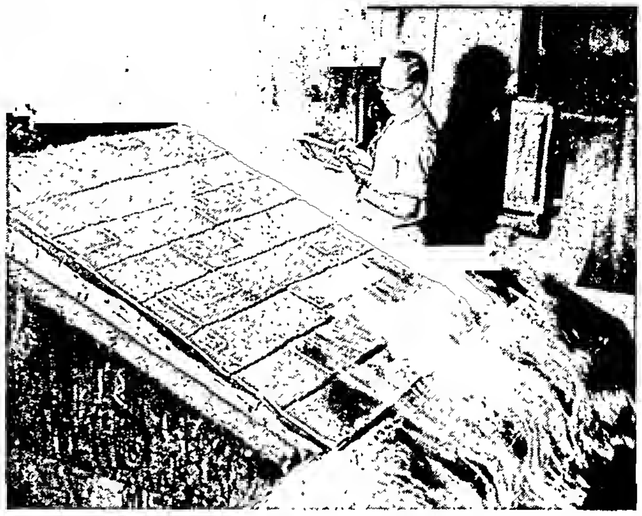
History of American Life Insurance

The first American life insurance company was organized in 1809 as a stock company. The first mutual

TESTS THAT LEAD TO BETTER FIRE PROTECTION



Electrical equipment is carefully examined in Underwriters' Laboratories. This engineer is using sensitive instruments to test an electric blanket for possible fire hazards.



The roof of a building helps determine its fire "risk." These asbestos shingles are being exposed to wind-driven flames to discover how well they resist fire.

policy was issued by the Mutual Life Insurance Company of New York in 1843. The New England Mutual also started business in 1843, and between 1845 and 1847 five other companies were organized.

The development of life insurance was one of the many social changes that appeared during President Andrew Jackson's administrations. At that time male suffrage was spreading, a new wage-earning class was rising, and individuals were awakening to new opportunities and responsibilities.

Since then life insurance has created some of the largest financial institutions in the world. Before the outbreak of World War II the total income of insurance companies in the United States exceeded the income of the federal government. This income consists not only of premiums but also of profits from investments. Life insurance companies own a large proportion of government bonds, utility and industrial bonds, railroad securities, and urban and farm mortgages. Since many mortgages have to be taken over, insurance companies own and manage various types of property. Some companies have built huge housing projects in large cities.

Since the assets of life insurance companies in the United States total billions of dollars and nearly all their funds are invested, these companies are powerful agencies of industrial investment. They are important sources of the credit needed to finance the nation's enterprises. To millions of policyholders, insurance represents a big part of their savings. It is also their chief source of credit when they need to borrow.

Other Types of Insurance

IN ADDITION to life insurance, there are other highly developed forms of protection such as fire insurance, marine insurance, casualty insurance, veterans' insurance, and workmen's compensation insurance.

How Fire Insurance Works

For many years, fire insurance experts have kept records of losses by fire. These include the number of buildings burned, the localities, and the losses in various types of construction and kinds of businesses. For example, a hardware store in a building with steel beams, brick walls, and a tile roof is less liable to burn than a lumber mill built of wood. As insurance men say, it is a "better risk." A wooden dwelling with a shingle roof is not as good a risk as one with a tile or slow-burning composition roof.

Premiums are adjusted according to the risk. This applies to localities as well as single buildings. Premiums are lower in cities well provided with fire-fighting apparatus than in villages that have only volunteer fire companies.

Fire insurance premiums are always computed on the basis of $100 of value. If paid up for three years in advance, fire insurance is sold at two and one half times the annual rate. The premiums build up reserves enough to meet all losses.

The use of poorly constructed stoves, faulty electrical equipment, inflammable building materials and the like involves great risk to life and property. Moreover, safety devices such as fire extinguishers, fire-resistant roofing, burglar alarms, and safes must be efficient and dependable if they are to prevent or reduce losses. Insurance underwriters work with manufacturers in attempting to eliminate hazards from such products. Much of this work is done through the Underwriters' Laboratories, a nonprofit organization founded in 1894 by the National Board of Fire Underwriters.

The laboratories test all sorts of devices and materials that affect risks to life and property. As a result, standards of safety have been set up, and manufacturers strive to meet them. Many insurers require that a manufactured product be tested by Underwriters' Laboratories before they will issue insurance involving it.

Marine Insurance—the World's Oldest

Marine insurance developed in the Middle Ages. It gives protection against the losses of cargoes or

ships at sea. Usually it covers a certain voyage between specific ports. It may also cover the anticipated profits of a voyage.

An outgrowth of ocean marine protection is *inland marine insurance,* called "floater" policies. This provides coverage for insured property wherever it is located. A personal property floater gives protection against damage to or loss of valuable personal property such as jewelry or furs. Other inland marine insurance may be written on goods "in transit" overland (shipped from one place to another), on salesmen's samples, and on furs being cleaned or stored.

The Broad Field of Casualty Insurance

Casualty insurance has more than 50 different forms covering a wide variety of hazards. The most common type is *automobile insurance,* which may provide several kinds of coverage. *Personal liability* coverage protects the insured against losses if other people are killed or injured in an accident involving his car. The purchaser may buy as much of this liability insurance as he chooses; for example, \$20,000 for each person and \$40,000 for each accident involving bodily injury. In some states, car owners are required to carry such insurance. A similar kind of insurance is *property damage liability* which protects the car owner against losses from damage his car may do to another's car or property.

A third type of automobile insurance covers physical damage to the insured's car. This includes *comprehensive* coverage, which gives protection against losses from fire, theft, and wind but not against losses from collision or upset. *Collision or upset insurance* is a separate coverage. It is often written as \$50 or \$100 deductible—that is, the insured pays for all damage up to the selected amount; the insurance company pays for damages exceeding that amount.

Another major form of casualty protection is *accident and health insurance,* often combined into a joint "disability" policy. It is designed to provide income protection for loss of earnings and expenses caused by disability from accidental bodily injuries or ill health. Payments to the insured, called an *indemnity,* may be made weekly or monthly. The policy may also include indemnities for "specific losses" such as the loss of sight or a limb. A form of accident and health insurance is the so-called "catastrophe" policy. In one type of this coverage the insured pays the first \$500 incurred for medical expenses and the insurance company pays the other expenses up to a figure such as \$5,000.

Accident and health insurance may be supplemented by additional coverage to provide for payment of hospital, medical, and surgical expenses. *Hospital* insurance may be obtained under an individual or group plan to cover an individual or an entire family. Such insurance usually pays room, board, and virtually all other hospital expenses for a certain number of days each year and a percentage of all expenses for an additional 60 or 90 days.

There are several other important types of casualty insurance. *Aviation insurance* usually covers damages to the plane and liability for accidental injury to persons and property. *Burglary insurance* gives protection against losses from theft. *Credit insurance* protects sellers against "above average" losses in the extension of credit to buyers. *Title insurance* safeguards ownership of property. *Liability insurance* has many forms. In general, the insurance company assumes the legal liability attached to the insured.

Through several of its agencies the federal government also provides insurance in some fields. These agencies include the Federal Crop Insurance Corporation, the Federal Deposit Insurance Corporation, the Federal Housing Administration, and the Veterans' Administration.

Insurance in World War I

Risks to life and property involved in war are often so great that insurance companies cannot underwrite them. In such cases, governments sometimes step in to assume the risks, for they have much greater resources to draw upon. It seems fair also that when a government sends men to war it should help them or their families bear losses caused by injury or death.

At the outbreak of World War I, in September 1914, the United States government began to insure its citizens' ships and cargoes against losses in the war zones of Europe. After the United States itself entered the war in 1917, it provided for life insurance for the crews of American merchant ships. All members of ships' crews were required to carry this insurance in an amount equal to 12 times their monthly wages, provided that amount was not less than \$1,500 or more than \$5,000.

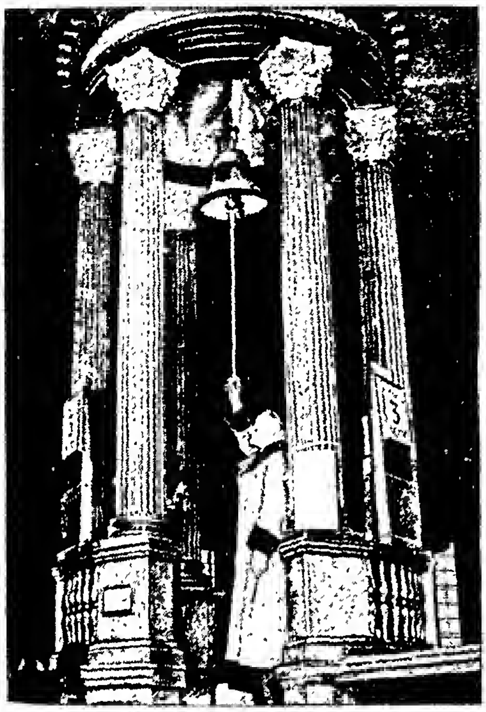
In October 1917, the United States established a system of War Risk Insurance for men and women in the military and naval services. Later it made government life insurance obtainable by those who had served in the armed forces of the United States from 1917 to 1921.

World War II and Korea Veterans

The National Service Life Insurance Act of 1940 made insurance available to those enrolled under the Selective Service Act of that year and to those already in service. In each case insurance was granted in amounts from \$1,000 to \$10,000. No person could carry a combined amount of more than \$10,000. Such insurance was not compulsory, except for those undergoing flight training. Insured persons paid premiums comparable to the rates for term insurance in peacetime. The government assumed the added war risks and paid the costs of administration.

Five-year term policies were issued. They were extended to eight years at the same premium if issued before Jan. 1, 1946. They may be renewed for periods of five years at higher premium rates or converted to ordinary life, 20-payment life, 30-payment life, 20-year endowment, endowment at age 60, or endowment at age 65. The amount of the converted insurance must be a multiple of \$500 and not less than \$1,000 or more than \$10,000. Premiums are based upon the age of the insured at the time he converts his policy unless he chooses to pay the difference between the

A WORLD-FAMOUS INSURANCE COMPANY AT WORK



Lloyd's of London is probably the best known of all insurance companies. Its Lutine Bell (from the frigate *La Lutine*) is rung to announce very important news (left). Underwriters (right) prepare insurance contracts for their agent members.

reserves of the old and new policies. If he pays this difference, the premiums on his converted insurance will be based upon his age at the time he first took out the term insurance or upon his age at an intermediate date he selects. Premiums may be paid annually, semiannually, quarterly, or monthly. The beneficiary may receive a lump sum or monthly installments.

Special dividends were paid in 1950 and 1951. Payment of regular dividends began in 1952. Some 5 million policies are carried as term insurance; another 2 million have been converted to permanent forms.

The Servicemen's Indemnity Act of 1951 replaced National Service Life Insurance. It gives free life insurance of $10,000 to all servicemen, retroactive to June 27, 1950. Veterans of any theater, who apply within 120 days after discharge, may get five-year term insurance. It is not convertible to permanent types. No new National Service Life Insurance policies may be issued, but old policies continue and lapsed policies may be reinstated.

Insurance for Workers

In nearly all the states employers are required to carry workmen's compensation insurance. This protects workmen and their families if the worker should be injured or killed in the course of his employment. Employers must either give proof of their ability to meet compensation risks or must insure their risks in state funds or private insurance companies. (*See also* Employers' Liability.)

Workmen's compensation is one form of *social insurance*. This term applies to forms of insurance which are provided to protect families having small incomes against various hazards such as illness and unemployment. Usually the insurance plan is prescribed by law. Those who are insured pay only part of the cost, often as a deduction from pay. Employers may pay all or part of the rest. The government also may pay a part from money obtained by general taxes.

Unemployment insurance appeared as early as 1824 when an English labor union set up a fund for members out of work. Similar voluntary systems grew up elsewhere. Compulsory unemployment insurance was introduced by Great Britain in 1911. Under this system (later called the "dole") contributions were made by the government, the employer, and the employee. Nearly every European country now has a national system, either voluntary or compulsory.

In the United States, Wisconsin was the first state (1934) to introduce such insurance, with contributions made by employers only. The federal Social Security Act of 1935 stimulated growth of this insurance. By 1938 all states had established compulsory unemployment insurance on the basis of contributions from employers. (*See also* Social Security.)

How the States Regulate Insurance

Every state has special insurance laws designed to regulate the activities of insurance companies. A state official, usually called an insurance commissioner, is responsible for enforcing these laws. One of the purposes of state regulation is to promote fair practices in the relations of insurance companies with their policyholders. The chief purpose, however, is to keep the companies in sound financial condition so that they will be able to meet their obligations. This is done by regulating the investment of the companies' funds.

Investments are made under the supervision of the state in which the company is chartered, and some-

times also under the supervision of the states in which it does business. All states permit life insurance companies to invest in bonds issued by the United States government or by other governmental units and in loans on real estate. Most states permit them to invest in bonds issued by railroads, electric light and power companies, and industrial companies. Some states allow investment in stocks as well.

In a few states life insurance is also sold by savings banks. Since there are no commissions on sales, the rate is cheaper, but the amount of insurance one can buy is limited. Massachusetts adopted this plan as early as 1907. It was not until 1939 that New York became the second state to enact similar legislation. Connecticut followed in 1941.

How Insurance Began

The principle of insurance can be traced back to the days of ancient Babylonia. Insurance as a business, however, is no older than the 14th century when Italian merchants began insuring ships. The earliest known life insurance policy was issued in England in 1583, and the first English insurance law was enacted in 1601.

About a century later, one of the most famous insurance firms came into existence. This was Lloyd's of London. It started about 1690 in the coffeehouse kept by Edward Lloyd. Businessmen interested in shipping and foreign trade came here, and some of them were willing to act as insurers, or underwriters. Ship owners and others looking for insurance underwriters soon went to Lloyd's to do their business.

To give the society more control over its members, Lloyd's was incorporated in 1871. The company does not write insurance. All the risks are assumed by individual underwriters. Each one is liable for paying losses on risks that he underwrites. The corporation audits each member's accounts and safeguards its members' interests. Lloyd's takes all forms of insurance except life.

The great development of insurance came with the spread of industrial organization between 1850 and 1900. Now it is possible to obtain protection against almost any kind of financial loss, including damage by cyclones, hailstorms, and earthquakes and losses from bad debts or from embezzlement by employees. Insurance companies may take over payments on personal loans, mortgages, and installment purchases if a debtor dies and has credit life insurance or if he becomes disabled by injury or illness and has consumer credit insurance. It is even possible to insure against loss of revenue caused by rain or snow on the day of a celebration, game, or fair.

How PSYCHOLOGISTS *Measure* INTELLIGENCE

INTELLIGENCE TESTS. John studies hard in school to keep up his grades. Bill seldom takes home a book. Both get "A" in the ordinary school examinations, which measure *how much* they have learned. But Bill rates much higher than John in intelligence tests, which measure *ability to learn.*

What does it matter whether Bill learns faster than John? Isn't it how much they learn that counts? Psychologists agree that success in school and in life depends upon how much people do—that is, upon achievement. But they point out that Bill *can do more* than John, if he makes full use of his abilities. So they want to arrange John's and Bill's schoolwork to let each one learn up to the limit of his ability. A school program of this sort promotes superior children rapidly, gives them extra assignments, or puts them in special classes where they can advance quickly. Slow learners have special chances to learn at rates suited to their ability.

Today psychologists can test intelligence in people of all ages, from babies to adults. Here we see a preschool child taking a simple test by stringing assorted beads.

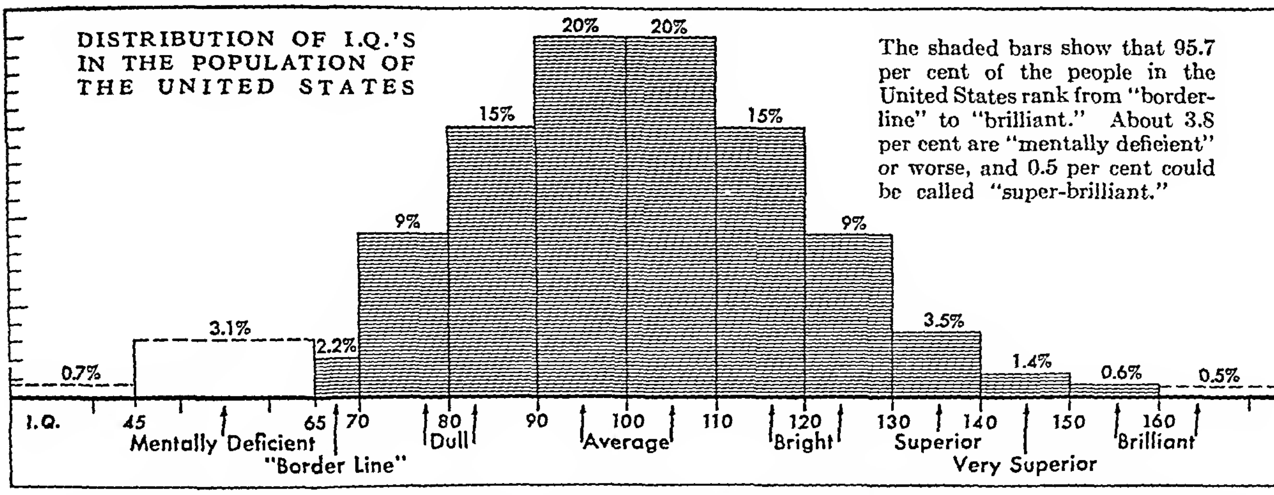
Efforts are also made to discover particular abilities. We have said that John ranks below Bill in all-round, "general" intelligence. But their tests may show that John is far ahead of Bill in mathematical ability. John wants to be an engineer; but his parents wonder whether he has all the abilities he will need. They arrange for a test at a special technical institute. John's score indicates that he would almost certainly be successful as an engineer. Tests that are designed to measure some particular ability or group of abilities, such as engineering ability, musical ability, or clerical ability, are called *aptitude tests.*

Of course success cannot be predicted on the basis of intelligence or aptitude alone. Opportunities vary; health may be a handicap. Character and personality are important. To test traits other than intelligence, psychologists have devised *personality tests* and *psychological tests.*

Practical Value and Uses of Testing

Psychologists realize that even the best tests cannot predict very accurately what a person will do in difficult or important situations. Nobody has invented

HOW DO AMERICANS RANK IN INTELLIGENCE TESTS?

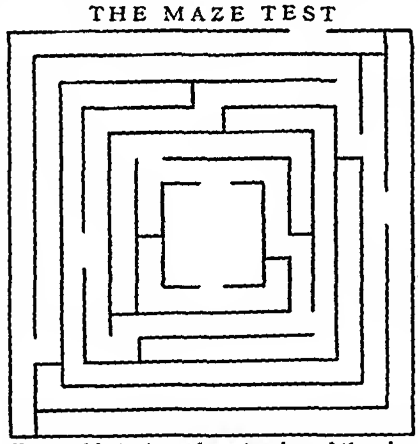


Of the first twenty people you pass in the street, the chances are that eight have average mental ability, five are dull, and five are bright. Of the remaining two, one is likely to be mentally deficient. The other may have superior intelligence.

reliable tests for measuring originality or the ability or willingness to concentrate for a long time on a single line of thought. Tests cannot yet pick out the rare genius in the schools. They provide only a rough guide in choosing a vocation. Nevertheless, they sort out the brighter from the less bright in groups, and help greatly in arranging groups for training.

Today millions of tests are given every year in the United States. Schools use them not only to guide students but to check the effectiveness of teachers and methods of instruction. Colleges use them as part of their entrance requirements. Large industries and the government rely on them to select new workers and discover their particular aptitudes. The United States Employment Service tests applicants for particular vocations. The armed forces use general intelligence tests, aptitude tests, and psychological tests to classify recruits.

THE MAZE TEST



To try this test, make a tracing of the picture. Then start in the center and mark with your pencil the shortest way out.

The First Intelligence Scale

In order to measure anything we must have some unit of measurement. We measure milk by the quart, sugar by the pound, cloth by the yard. But what unit can we use to measure intelligence? Early in the 20th century a French psychologist, Alfred Binet, offered the first answer. He called his yardstick Mental Age.

School authorities in Paris had asked Binet, "Find out some way to pick out the feeble-minded children in the schools." But Binet wanted to do more. He wanted to produce a scale that would measure the mental ability of *every* child "as with a ruler." He did not care whether he was measuring inherited ability or the results of training. He did not try to answer the question, "What is intelligence?" He realized that whatever intelligence may be, it could be detected and measured in behavior. So he tested hundreds of children to find out what tasks most children at each age could do.

When he had worked out tests for the different ages, Binet arranged them according to age in a "scale." If a child of seven could pass the seven-year test but not the eight-year, he was said to be "at age"—of average intelligence for his age. If a seven-year-old could get no further than the five-year test, he was said to have a mental age of five—two years retarded. Bright children could pass the tests for a year or more beyond their age. In 1908 Binet and Théophile Simon published a complete scale for children from three to thirteen years old. This Binet-Simon scale launched intelligence testing.

Intelligence Quotient or "I.Q."

Psychologists soon found that ratings on the Binet-Simon scale seemed to change progressively for better or for worse. A bright child might pull from one to two years ahead of his group during his school years. If a child was one year retarded at the age of six, he usually continued to fall behind until he was perhaps two years retarded at the age of 12. Psychologists needed a scoring method that remained more nearly constant for the individual. They wanted also a measuring unit that would not be stated in terms of age or time.

In 1914 a German psychologist, William Stern, met both needs. He found that even though a child fell back from one to two years behind his age group, the *rate* of his "falling back" tended to remain constant. Thus: 6 is to 5 as 12 is to 10. Professor Lewis Terman of Stanford University, California, checked Stern's ratio scoring with his statistics and popularized it in the Stanford revision of the Binet-Simon scale. Stern had called his new scoring measure the Mental Age

INTELLIGENCE TESTS USE THESE KINDS OF PROBLEMS

Some effective subtests for general intelligence are shown below. They have proved their worth through "trial and error." Experience shows that a bright child does better with them than a dull child of the same age.

Classification. Look across each row and underline the word that does not belong with the other four, for any one of a number of reasons.

oak	ash	grass	fir	elm
some	all	often	none	most
books	cloth	dishes	legs	top
dog	cat	horse	bird	pony

Series. Look across each row of numbers and in the two spaces write the numbers that should come next to continue the series.

2 : 4 : 6 : 8 : —— : ——
1 : 3 : 2 : 4 : —— : ——
27 : 27 : 23 : 23 : —— : ——

Completion. Fill in the spaces in this sentence.

Birds have —— which enable them to —— through the ——.

Antonyms. Antonyms are words of opposite meaning, such as *wet* and *dry*. Underline a word in each row that appears to you to be opposite in meaning to the first word.

ALLIES forces friends neighbors enemies
SLAVERY misery poverty freedom
EDUCATED scholarly illiterate literate
CRUEL brutal kind savage

Synonyms. Synonyms are words having the same or nearly the same meaning, as *wet* and *moist.* Underline the word in each row that appears to you to have the same meaning as the first word.

ABUNDANT plentiful enough good scarce
PUPIL eye expert teacher student
IMITATE resemble artificial like copy
INTELLIGIBLE truthful vague direct clear

Analogies. Analogy means a similarity in *relations* between things that may otherwise be entirely different. Thus: "sugar" is to "sweet" as "vinegar" is to "sour." In each line below, the first two words are related in some way. Underline the word that is related in the same way to the third word.

FISH is to SWIM
as MAN is to paper time walks girl
SHOE is to FOOT
as HAT is to coat nose head collar
DISMAL is to CHEERFUL
as DARK is to sad stars night bright
AIR is to MAN
as WATER is to birds snakes fish trees

Detecting Absurdities. Underline a key word that is "sensible" or "silly," and write which it is.

A man stopped another in the street. "Pardon me," he said. "I recall your name but I can't remember your face."

Quotient. Terman called it the Intelligence Quotient, or I. Q.

A quotient is the answer you get when you divide one number by another. To get the Intelligence Quotient, you divide mental age by age in years. If the two numbers are the same, the quotient is 1. The child is "at age." If the mental age is 10 and the age in years is 8, the quotient is 1¼ (in decimals, 1.25). To avoid both fractions and decimals, Terman multiplied the answer by 100, thus:

$$\frac{10 \text{ (mental age)}}{8 \text{ (age in years)}} \times 100 = 125 \text{ I.Q.}$$

According to this method, 100 is "normal" for a person of any age. The graph on the preceding page shows the distribution of intelligence at, above, and below normal in the United States.

How Intelligence Grows in Children

These tests revealed that a child's mental ability increases rapidly during the first seven years of life. At seven the brain itself is almost adult size. For about eight years more ability continues to grow, but less rapidly. Then it levels off.

The normal child reaches the peak of his mental ability at about the age of 15. Children of superior intelligence continue to increase their powers until they are 18 or even older. Mental defectives and primitive races, such as the blacks of Australia, show no improvement after about the age of 12.

When a child reaches the peak of his mental development he can solve any problem, if he has the necessary training and experience, that he can hope to solve in adult life. As he grows older he continues to amass knowledge, improve his skills, and grow in judgment and in wisdom. Hence he may not reach the peak of his powers until he is 40 or even 60. But he is not likely to increase his ability to *learn.* Indeed, after about the age of 25, his speed in acquiring new learning begins to decline very gradually.

Scoring the Intelligence of Adults

Since mental ability levels off early, I. Q. scoring is not well adapted for use with adults. A brilliant man of 60 might get top score on a mental age scale; but if his score were to be divided by 60, he would be rated as mentally defective. In measuring the I. Q. of adults, therefore, the chronological age is assumed arbitrarily to be 15 or 16.

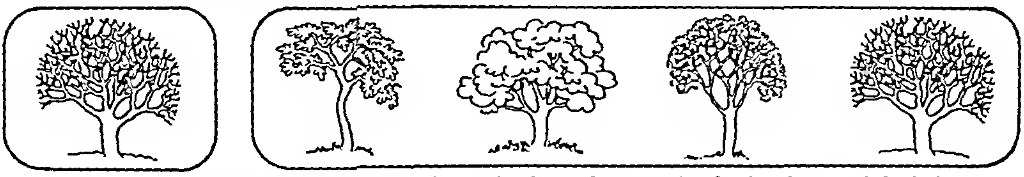
This method of scoring works out well enough for adults below average in intelligence; but it cannot be applied to the upper half of the population. If mental age levels off at 16, it is meaningless to say

PICTURE TESTS OF SPECIAL ABILITIES FOR AGES FIVE AND SIX

These tests were prepared at the University of Chicago by L. L. Thurstone and Thelma Gwynn Thurstone. They reveal individual differences in children by measuring primary mental abilities. The findings help teachers and parents plan the child's studies.

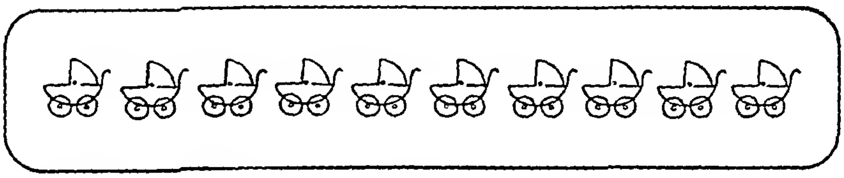
PERCEPTUAL SPEED

Mark the baby all by itself in the little box. Look at the babies in the big box and find the one that is exactly like the baby in the little box. When you find it, put a mark on it.



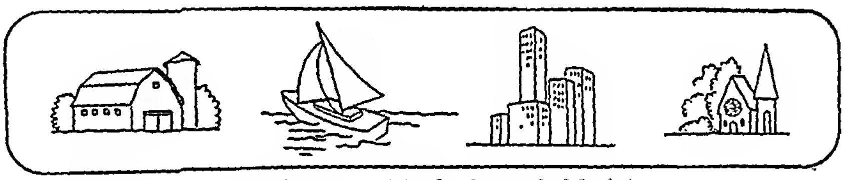
Mark the tree all by itself in the little box. Look at the trees in the big box and find the one that is exactly like the tree in the little box. When you find it, put a mark on it.

QUANTITATIVE ABILITY

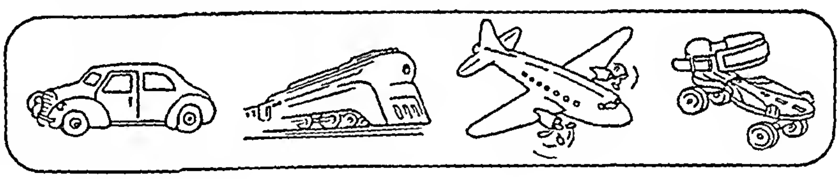


Mark six of the buggies.

VERBAL ABILITY

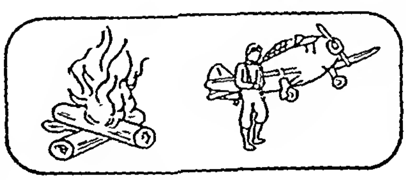


Which one do you see when you visit the farmer? Mark it.

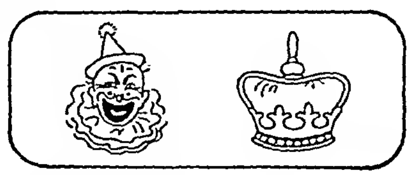


Mark the airplane.

AUDITORY DISCRIMINATION

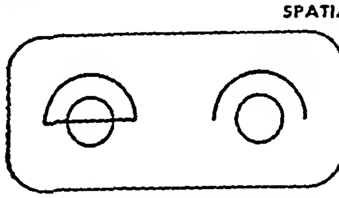


Fire and flier.
Mark the fire.

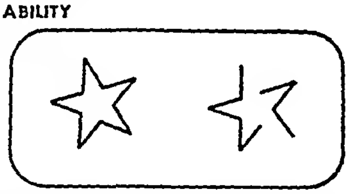


Clown and crown.
Mark the clown.

SPATIAL ABILITY



The teacher drew the first picture. The children tried to draw a picture just like the teacher's picture but they didn't quite finish it. Their picture is at the right. You finish it for them.



The teacher finished her drawing. The children didn't quite finish their drawing. Finish the children's drawing for them. Make the children's drawing look just like the teacher's drawing.

that a person has a mental age of 20. A simpler method of scoring adults is the *percentile rating.* This gives a person's relative rank in the group measured. If a college freshman gets a percentile rating of 81 on his intelligence test, it means that he surpassed 80 per cent of the freshman class. Percentile ratings are used also for scoring special abilities.

Individual and Group Tests

The early tests were individual tests. A trained examiner gave them orally to one child at a time. Testing a single child took from 30 to 90 minutes. When the United States entered the first World War, the army asked psychologists to make up tests that could be given to large groups by a single examiner. A few psychologists had already experimented with written tests for groups, but no satisfactory scales had been constructed.

Soon the army psychologists produced two scales. The Alpha scale was used for recruits who could read and write English. The Beta scale, cleverly worked out with pictures and diagrams, was used for illiterates and foreigners. The men were given intelligence ratings from A to D—. Out of 1,727,000 who took the tests, about 10,000 were rejected for army service because of mental deficiency. The rest were assigned, according to their ratings, to various branches of the service or given specialized training. The results proved that the tests had sorted out the soldiers fairly well, according to their ability.

This success brought an enormous expansion in the use of intelligence tests. Psychologists constructed group tests for schools, colleges, industries, and government personnel offices. But they did not neglect the individual test. They still find it the only practicable test

for babies and preschool children (*see* Child Development). Some psychologists still consider it more revealing and accurate than group tests for older children.

Building up an intelligence scale for school use is a long and tedious task. Various subtests must be devised for each age group. These subtests must be of equal difficulty. First the tester devises about twice as many items for each test as he will finally use. Next he arranges the items from very easy to very hard, largely by guess work. Then he gives his tests a first tryout with several hundred children. He discards items that prove too easy or too hard, and rearranges the rest in proved order of difficulty. Usually he does this two or three times before the scale is ready for general use.

What Is Intelligence?

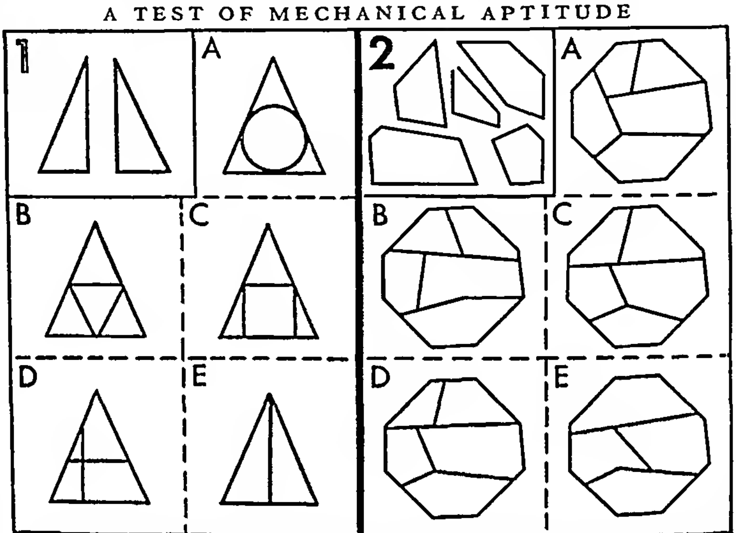
Binet set out to measure intelligence without being quite sure what it was he was measuring. He was satisfied with such common-sense definitions as "the ability to learn," "the ability to solve new problems," "the ability to adapt to new situations." Today psychologists ask: Is intelligence a single ability, or is it made up of many different abilities? What mental processes are involved? Are there perhaps some special abilities that lie outside "general" intelligence? To answer these questions they are devising new tests.

The early tests were a hodgepodge of tasks and puzzles. The total score was all that mattered. Psychologists now divide tests into subtests, and design each subtest to sample some particular ability. If intelligence is a single ability, a child should do as well with one subtest as with another. But if intelligence is made up of several abilities, the child's score should vary.

Results with this newer type of test show that a bright child will solve any kind of problem more easily than a dull child. To this extent, intelligence is a "single ability." But the new tests show also that for everyone some things are easier to learn than others. Moreover, people vary in what they find easier and harder.

A person with a high I. Q. may have a poor memory. Memory itself seems to be a complex quality. One person may remember telephone numbers easily, another poetry, another melodies. Some people, when they recall an important event in their lives, see a vivid picture. Others remember more clearly the words that were spoken. A mathematician who is skilled in theory may be so poor in "number facility" he will have to have an accountant compute his income tax. Aptitudes such as musical ability, artistic ability, or mechanical ability are not single abilities. Each is a complex made up of a number of factors. These factors, as well as they can be detected and defined, are called *primary abilities*.

A TEST OF MECHANICAL APTITUDE



Look first at Problem 1. Which of the lettered figures is made up of the two triangles in the first box? Obviously, E. Now try Problem 2. Many problems of this type are used in the Minnesota Paper Form Board Test.

Aptitude and Preference Tests

Some school tests are designed to predict aptitudes for particular school subjects—mathematics, language, or science—as well as general scholastic aptitude. Others sample such fundamental abilities as memory, word fluency, facility with numbers, power of visualization, speed in perceiving, and ability to reason. No single test has been devised that can tell precisely what particular vocation a person should follow. But "preference" tests will help anyone find out what he really would *like* to do. They can be followed with aptitude tests for particular vocations that prove interesting.

Here is an example of a preference test: Suppose that Roy, a high school graduate, asks the United States Employment Service about a job. After some informal questions, the service counselor hands Roy a list of several hundred "things to do." The items are arranged in groups of three. In each group Roy is asked to indicate which activity he likes most, which least. He is given as much time as he wants to ponder. Here are some sample questions from Kuder's 'Preference Record':

Work mathematical puzzles
Play checkers
Work mechanical puzzles

Press a suit
Put up a new shelf in the pantry
Chop wood

Manage the lighting for an amateur play
Be the business manager of an amateur play
Act in an amateur play

When the test is scored, the counselor finds that Roy is decidedly interested in mechanical things and has some interest in tasks requiring simple bookkeeping. He likes to persuade other people to his way of thinking. He has very little interest in science. He would never go out of his way to visit a library, to hear a recital, or to attend an art exhibit.

But mere interest is not the same as aptitude or ability. So the counselor measures Roy's mechanical aptitude with *performance* tests. While the examiner times him with a stop watch, Roy puts pins three at a time into a hundred holes in a metal board. Then with tweezers he drops pins from another pile into holes just large enough to hold them. These tests rate his finger dexterity and "tweezer dexterity." Other tests with apparatus measure his manual dexterity, his arm-and-hand coördination, his ability to do one thing with one hand and something else with the other. Roy scores fairly high in these tests. Then the examiner shows him a rectangular block and separates it into nine irregular, wavy pieces. Roy spends a very long time putting this three-dimensional jigsaw puzzle together. A paper-and-pencil test for space perception follows. Roy's time is up before he is halfway through the 64 problems.

Next Roy takes a test for clerical aptitude. Is he careful and accurate? This test, like the others, requires no previous training. He is asked, for example, to compare two long columns of figures and make a check on the dotted line between them if the pairs are not alike.

63015991	....	63019991
39007196	....	39007106
69931087	....	69931087
2501004818	....	251004418
299056013	....	299056013

When the tests have been scored, the counselor tells Roy that he might learn to do some job requiring a high degree of manual skill. But he would never be a first-rate mechanic, because he rates too low in space perception. He has little aptitude for clerical work, but his "interests" record shows a high rating for "persuasiveness." He takes a test for salesmanship and comes out with flying colors. The counselor advises a course in selling and tells him that he would find it easy to demonstrate any kind of machinery. Roy becomes an airplane salesman.

Tests for Musical and Artistic Talent

One of the most widely known aptitude tests is the Seashore test for musical talent. It is made up of a number of single tests, run off on phonograph records. It measures such fundamental aptitudes as the ability to notice small differences in pitch, in time, and in the intensity of tones; memory for tones; sense of rhythm; and the ability to discriminate between harmonious and inharmonious combinations. The test can be taken by a person who does not know musical terms and has had no musical training.

Aptitude tests have been designed also to predict artistic ability. The prospective student may be asked to choose the most pleasing of several figures which differ in proportion; to indicate where shadows should be placed in an outline picture; to mark lines in faulty perspective; and to recognize and name colors. To test originality, he may be asked to produce a drawing, using groups of dots arranged at random.

Tests of Personality and Character

When we know a person's I. Q. and his aptitudes, we still have only a partial description of him. To fill in the picture, psychologists have devised various tests of personality and character. Personality is a composite made up of many different traits. It is difficult to appraise it as a whole. Even if all the traits could be named and measured, there would still remain the question: How are these traits related, how do they affect one another?

Most personality tests are not tests in the usual sense of the term. They do not try out a person in various social situations to see how he behaves. They are more like questionnaires. The subject is asked to answer "yes" or "no" to such questions as:

Do you find it difficult to make decisions?
Are you afraid of falling when you are on a high place?
Are your feelings easily hurt?
Do you usually get turned around in new places?
Do you daydream frequently?
Do you laugh easily?

If the subject does not answer honestly, the test has little value. For this reason the questions are sometimes disguised so that their purpose is not evident. In a "free association" test the subject is given a word and asked to say quickly the next word that comes into his mind. Or he is asked to look at ink blots and say what they suggest to him (the Rorschach test).

Personality tests attempt to discover such traits as dominance or submissiveness, self-sufficiency or dependence, sociability or shyness. *Character tests* rate reliability and honesty. *Psychological tests* aim to uncover neurotic tendencies, such as inability to face reality, moodiness, sensitivity, or anxiety.

Finding the Right Duties for Soldiers

The tests developed for the first World War rated the men only on their general intelligence. In the second World War recruits spent five days at reception centers being tested, classified, interviewed, and assigned. A psychological test eliminated those who would probably not be able to adjust themselves to army life. The General Classification Test rated those accepted in five groups: Grade I, superior; II, rapid learning; III, average; IV, slow learning; V, backward or illiterate. Subtests in the General Classification Test measured proficiency in simple arithmetic and mathematics, vocabulary, and general aptitude for mechanical or clerical work. Those with top score (Grades I and II) were given further examinations to pick out those best fitted for specialized service, including officer training. Grades III and IV were further tested for aptitudes or trade knowledge that would be useful in a highly mechanized army.

Heredity or Environment?

One great objective of intelligence testing is to help us know which traits are inherited and which are shaped by environment. For example, can a person raise his I. Q., or is it born in him and unchangeable? This is a fundamental problem in psychology; and as yet no complete answer is in sight. From birth onward the effects of heredity and environment are so interwoven that it is practically impossible to separate them by any tests now known. (*See also* Individual Differences; Child Development; Mental Deficiency.)

Bringing BEAUTY *into the* HOME

This room, created by an American designer, is modern in furnishings and arrangement. The furniture is both graceful and comfortable. It has simple lines and little ornamentation. The chairs are light and easy to move. The pieces are grouped to serve different needs: eating or playing cards, writing and study, and conversation. There is plenty of uncluttered space.

INTERIOR DECORATION. To create a beautiful home is every woman's dream. It is a dream she usually shares with her family. And the dream can be realized, whether the setting is a small apartment or a spacious house. Beauty in home furnishings does not depend on costliness. Furniture is made in a variety of styles, paint in many beautiful colors, fabrics in a host of designs and textures, rugs and carpets in styles and colors to suit any interior. The homemaker with knowledge and taste does not need a limitless bank account.

When a family is about to improve its home or create a new one, the first question usually is, "What kind of furniture shall we buy?" Furniture stores and furniture departments can prove bewildering. Unless the family has studied what is available and has planned carefully, they may buy unwisely. And most people have to live with the furniture they buy, whether they like it or not.

Becoming familiar with "period furniture"—the styles of the past—and with good modern designs is the first step toward a satisfactory selection of furniture. People who look at enough furniture and enough pictures of furniture, studying the details, learn what style they prefer. In addition, they learn which styles can be combined effectively.

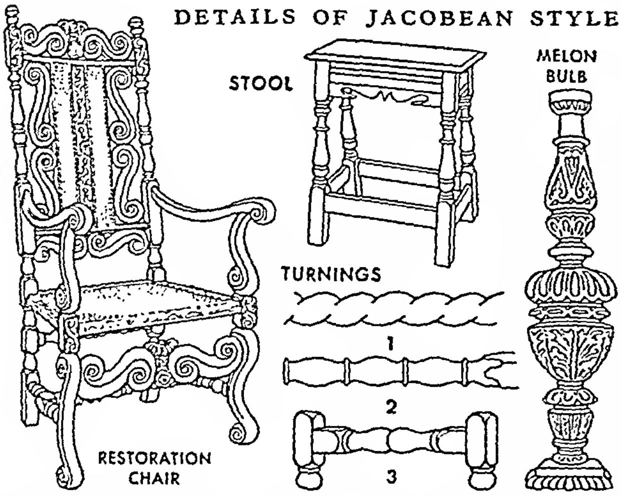
One of the best ways to study period furniture is to look at Mrs. James Ward Thorne's miniature rooms. Mrs. Thorne planned these rooms after many years of study and experiment. Expert craftsmen made the furnishings and built the rooms after authentic originals, following a scale of one inch to one foot. The rooms are in two series, European and American. Mrs. Thorne presented both series to the Art Institute of Chicago. This museum exhibits them not only in Chicago but in other cities and towns.

Reproduced on the following pages are photographs of nine Thorne rooms. These represent the styles of the past that are most popular today—those best adapted to modern living. Accompanying the photographs are sketches that emphasize details of the periods illustrated. A table on page 178 gives the dates for English, French, and American periods.

Furniture in Tudor England

Social life under the Tudor kings and queens of England was boisterous. Furniture was built to stand hard wear. It was made of oak in massive rectangular shapes. Carving adorned most pieces. This was done in Gothic designs at first and later in classic designs inspired by the Italian Renaissance. Pieces were chiefly huge canopied beds, trestle and draw tables, benches, stools, large chairs, and cupboards.

DETAILS OF JACOBEAN STYLE



The furniture shown above is Jacobean. Characteristic turnings are (1) twisted rope, (2) spool, and (3) composite. Melon-bulb turning became more slender and less ornate as time passed.

Benches were often of the type known as settles, with paneled backs. Many of the chairs were *wainscot chairs.* In these the back was a solid panel and the seat a solid piece. Some Elizabethan chairs had triangular seats. *Court cupboards* combined the uses of a serving table and cabinet. They had two sections. The upper one was closed, with doors or drawers. The lower one might be open or closed.

Runglike pieces of wood called *stretchers* connected the legs of chairs, tables, and cupboards to give stability. Carving in the shape of a melon bulb became a feature of legs and other furniture supports during the reign of Queen Elizabeth I.

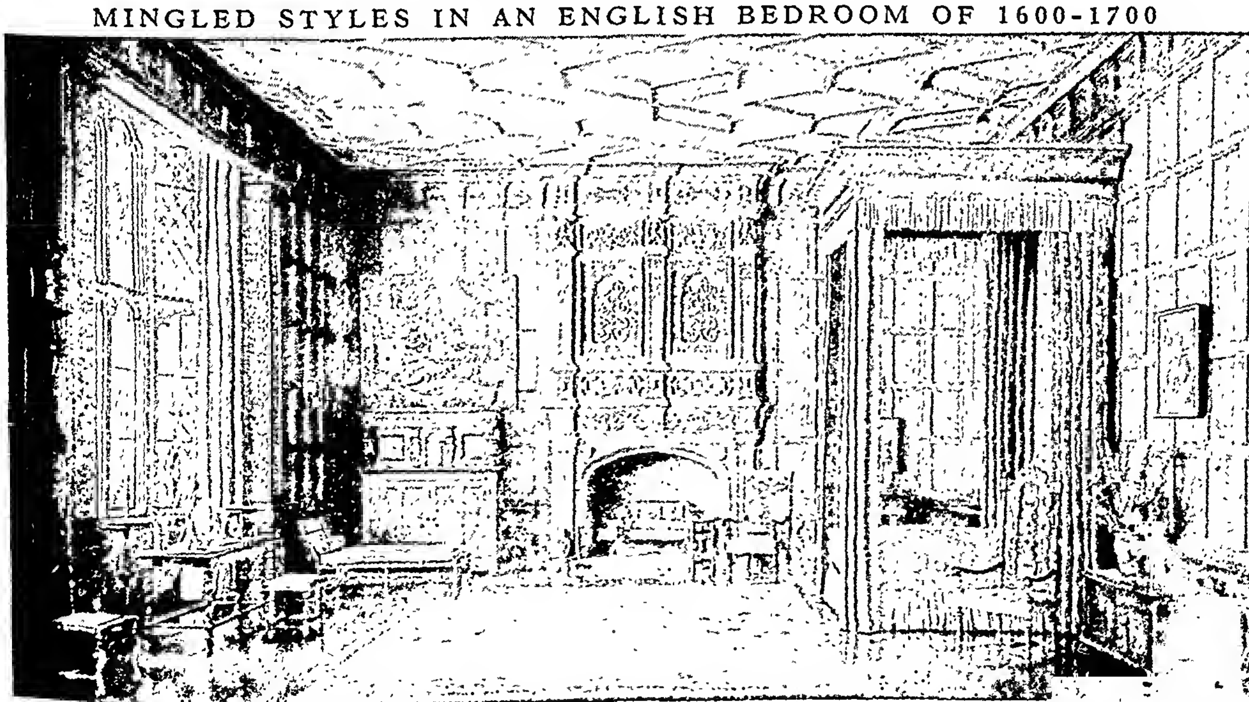
Furniture remained rectangular in the early Jacobean period but was not so heavy. Chairs often had cushions nailed to the backs and seats. Swing-leg tables appeared in a variety of styles and sizes. The legs of tables and chairs became less bulbous. Some were columnar. Others were shaped, or *turned,* to look like twisted rope, spools set end to end, and other spiral-like forms.

Furniture had less decoration during the Puritan régime of Cromwell. Turning and other types of carving were simpler. Reaction occurred with the restoration of Charles II to the throne. Charles had lived in France during his exile. He brought French ideas of luxury back to England. Decoration became elaborate. Carved scrolls and crowns were characteristic. Furniture makers—or cabinetmakers, as they were called—began to use walnut instead of oak. Walnut is strong but not heavy and takes carving well. They introduced new, luxurious kinds of furniture, including long chairs similar to day beds, wing-back chairs, sofas, mirrors with carved frames, and draped beds. Typical chairs had cane backs and seats. Others, like many of the sofas, were upholstered in rich fabrics, such as velvets and brocades.

The period of William and Mary is the first in which furniture was homelike. William and Mary ruled England by invitation of the British. They were not monarchs by "divine right." Ostentation might have reacted against them. And their tastes were naturally simple and domestic. During their reign, both rooms and furniture became smaller. Grandeur in furniture gave way to beauty of finish.

Walnut was the chief wood. Scrolls and crowns disappeared. Legs were turned in shapes that resembled inverted cups, bells, and trumpets. *Bun feet* (flattened spheres) were popular. Flat stretchers curved

MINGLED STYLES IN AN ENGLISH BEDROOM OF 1600-1700



Most of the furniture in this manor house bedroom is in Restoration (late Jacobean) style. The court cupboard and chest, however, are Elizabethan, and the two chairs on the right belong to the period of William and Mary. Architecturally, the room is late Tudor. This mingling of styles was natural in a home where the family lived through many periods.

from a center piece toward the four legs, like a curved X. Such stretchers are called *serpentine.*

Highly polished veneer was a favorite finish. Veneer is a thin piece of wood, usually with a beautiful grain, glued to a heavier under piece to make a decorative flat finish. A further development of the method is to set many small pieces of contrasting woods into a surface to make a design. This is called *inlay* or *marquetry*. Elaborate inlays were a feature of William and Mary furniture. Lacquer finishes were also popular. Queen Mary set a fashion for embroidery. It was used for padded chair backs, draperies, and screens.

Furniture was simple and elegant during most of Queen Anne's reign. The curved line predominated. Legs had a graceful double curve (*cabriole legs*). Improved methods of construction made stretchers unnecessary after 1708. The typical chair had a *splat back*—a flat, vertical piece set into a frame. Often the splat was scrolled and suggested a violin shape (*fiddle-back*). Scallop shells, acanthus leaves, and broken curves provided designs for carving.

People in general were taking more interest in having attractive, comfortable homes. Prosperous farmers and middle-class people in towns extended the market for good furniture. The hoop-and-spindle type of chair known as *Windsor* became popular for small homes. Some Windsor chairs had cabriole legs. Others had spindle legs joined by rungs. There were many small tables on which to serve coffee, tea, or chocolate. Some had a *tilt top*. Some had a *pie-crust* edge. Others had a *gallery top*—a top with a little railing around the outer edge.

As the Queen Anne period merged into the early Georgian, furniture became heavier and somewhat more ornate. Cabriole legs ended in ball-and-claw feet. Splat backs were pierced into cut-out designs. There was more carving. Walnut was still the favored wood, but cabinetmakers used some mahogany. In 1720 the government imposed a high import duty on mahogany. This limited its use for a number of years.

In the Georgian period the court no longer dominated the lives and interests of the people. There was a strong, wealthy middle class eager to have fine homes. Thomas Chippendale, Robert and James Adam, George Hepplewhite, and Thomas Sheraton created beautiful furnishings to meet the demand.

PERIODS IN FURNITURE DESIGN

ENGLISH

Tudor (1500–1603): Named after the ruling house. Henry VII, Henry VIII, Edward VI, Mary I, and Elizabeth I.
Jacobean (1603–89): Name derived from James. Also called Stuart period, after the ruling house.
  EARLY JACOBEAN (1603–49). James I and Charles I.
  CROMWELLIAN, or PURITAN (1649–60).
  RESTORATION (1660–89). Also called Carolean, after Charles II. Charles II and James II.
William and Mary (1689–1702).
Queen Anne (1702–14).
Georgian, or 18th Century (1714–1810).
  EARLY (1714–50). George I; part of reign of George II. Early Chippendale designs.
  MIDDLE (1750–70). Parts of the reigns of George II and George III. Middle Chippendale period.
  LATE (1770–1810). Last part of reign of George III. Chippendale, Adam brothers, Hepplewhite, Sheraton.
Regency (1810–20). Regency of George IV.
Victorian (1830–1901).

FRENCH

Louis XIV (1643–1715).
Regency (1715–23). Regency of Louis XV.
Louis XV (1723–74).
Louis XVI (1774–89).
Revolution and Directoire (1789–1804). Period of stagnation. Louis XVI style.
Empire (1804–14).

AMERICAN

Early American, or Colonial (1608–1720).
Georgian (1720–80).
Federal (1780–1830)
Victorian (1830–80).
Eclectic (1880–1925).

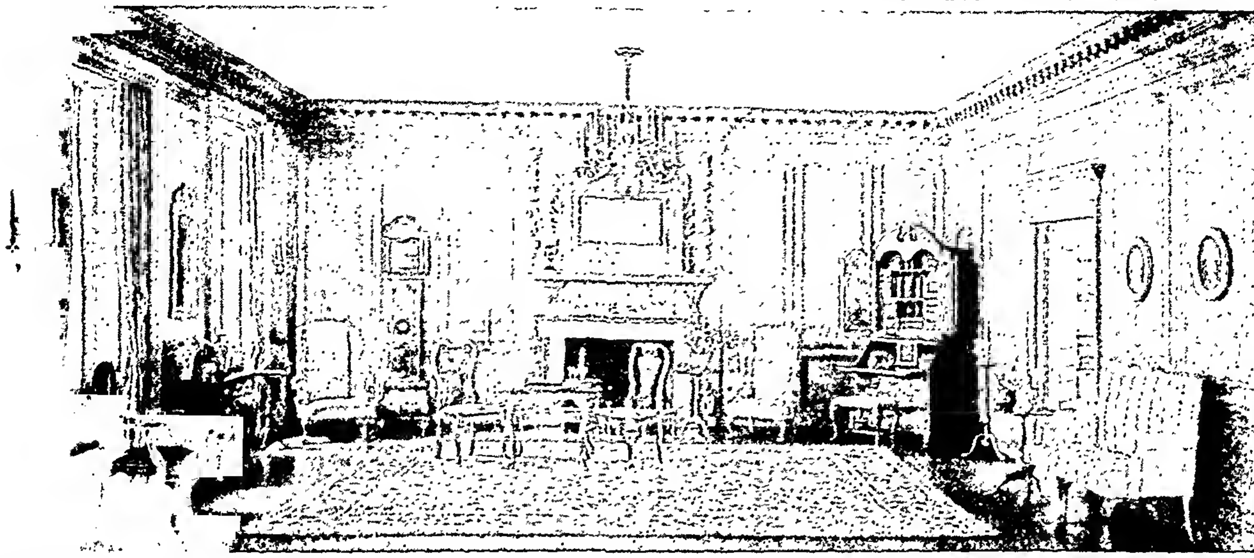
The English government removed the import duty from mahogany in 1733. Chippendale worked almost entirely in this wood. He had four major phases: English, French, Gothic, and Chinese. His English phase was a development of the Queen Anne style. His French phase reflected the highly ornamental style of Louis XV. In his Gothic designs he used pointed arch patterns. His Chinese style had straight-line latticework, or *fret*, suggesting Chinese designs. His chairs illustrate each phase. The splat backs had, in turn, graceful scrolls, elaborate ribbon designs, pointed arches, and interlacing straight lines or pagodalike patterns. The legs were either cabriole or straight.

Robert Adam brought a classic revival to England. Inspired by the excavations at Pompeii, he used Greek and Roman forms and stressed classic symmetry—perfect balance and restraint as opposed to free, natural design. He and his brother James were architects and designed furniture only because they wanted it to suit the interiors they built. Furniture made to their designs had straight lines combined with broken curves rather than free-flowing curves. Ornamentation, often painted, took the form of rosettes, vases and urns, rams' heads, Grecian fret, and *swags*, or festoons.

The Adam brothers influenced both Hepplewhite and Sheraton. These men created furniture of great delicacy and elegance. Both used straight, tapering legs. Hepplewhite's chair backs were in curved shapes—ovals, hearts, shields, and wheels. Sheraton's were rectangular. Hepplewhite used some delicate carving, much painted decoration, and some inlay. A favorite design was the three-feather Prince of Wales crest. Sheraton preferred inlay. Both men worked in satinwood, a yellow-brown wood similar to mahogany.

During the Regency, when George IV ruled for George III, cabinetmakers began to copy Greek and Roman designs enthusiastically. They created little that was new. Inspiration did not revive during Victoria's reign. The Industrial Revolution stifled the creative spirit as it introduced machine production. A lasting contribution of the period, however, was the development of chintzes (*see* Textiles). Machine-made furniture utilized the designs of the past with little discrimination. For a while homeowners relegated beautiful Georgian furniture to

ENGLISH STYLES IN A MASSACHUSETTS COLONIAL MANSION



A wealthy New England shipowner, Col. Jeremiah Lee, built this home in Marblehead, Mass., in 1768. The walnut paneling reflects the influence of the English architect Sir Christopher Wren. Colonel Lee is said to have had much of the wallpaper and interior woodwork of the house made in England and brought to America in his own ships. The furnishings shown here represent the Queen Anne period and Chippendale's early work. The side chairs are beautiful examples of the fiddleback design.

back rooms and attics. But they soon restored it to places of honor. The designs of Chippendale, the Adam brothers, Hepplewhite, and Sheraton have since remained favorites in England and America.

Magnificence in France

The first period in which France had a distinctively French type of furniture was the reign of Louis XIV. This was an age of splendor. Furniture was massive and often gilded. Dominant lines were rectangular. There was a great deal of carving, much of it in animal forms. Upholstering was done in rich fabrics. Gold fringe was a typical trimming. André Boulle, master cabinetmaker to the king, introduced *ormolu* and *boulle* decoration. In ormolu, mounted ornaments were made of gilded metal. Boulle work was an inlay carried out with tortoise shell, brass, mother-of-pearl, and other materials.

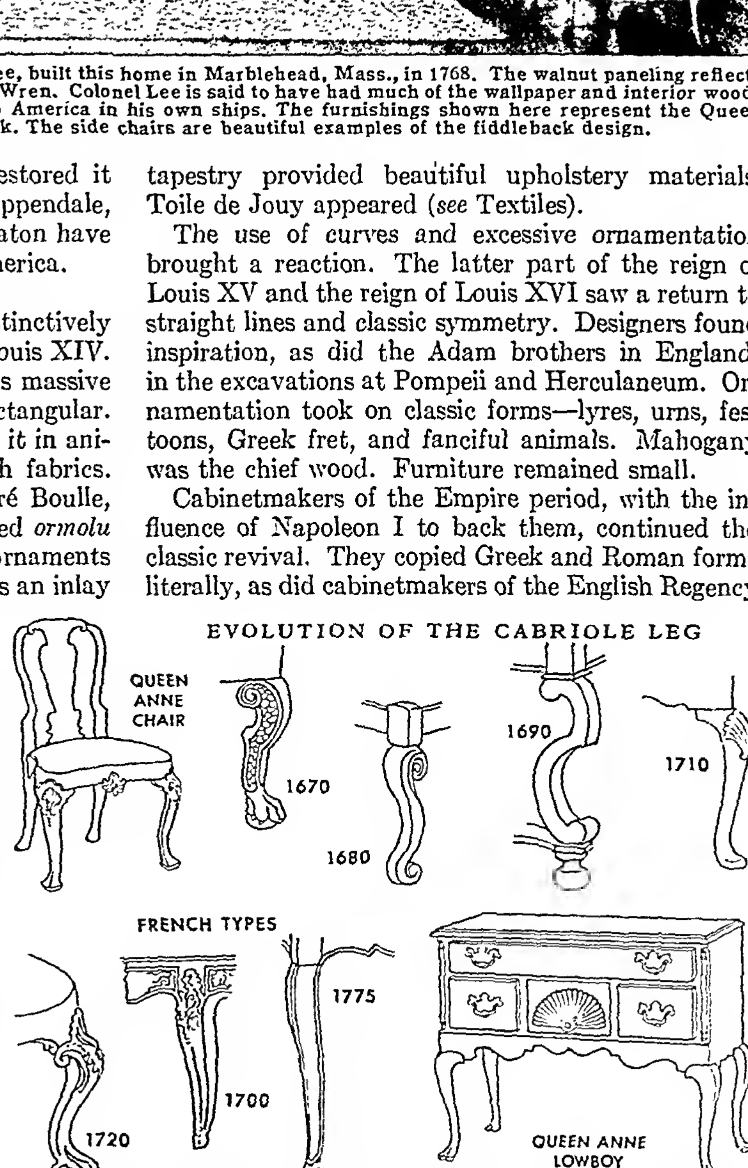
The last years of the reign of Louis XIV and the regency of Louis XV were a transition period. Furniture was becoming smaller. It was acquiring curves. The cabriole leg appeared. The foot usually was carved to represent a deer's hoof.

During most of the reign of Louis XV, cabinetmakers avoided straight lines. They used curves with the utmost freedom both in over-all design and in ornamental detail. Cabriole legs had scroll feet. The fronts of desks, commodes, and cabinets had a *bombé*, or *bulging*, shape or a combination of convex and concave curves known as *serpentine*. Furniture was both comfortable and ornamental. Much of it, in fact, was over-ornamented. Painted and lacquer finishes in light, soft colors were popular. Ormolu continued in use, as did marquetry. Chairs often had cane backs. Fine silk, leather, embroidery, and tapestry provided beautiful upholstery materials. Toile de Jouy appeared (*see* Textiles).

The use of curves and excessive ornamentation brought a reaction. The latter part of the reign of Louis XV and the reign of Louis XVI saw a return to straight lines and classic symmetry. Designers found inspiration, as did the Adam brothers in England, in the excavations at Pompeii and Herculaneum. Ornamentation took on classic forms—lyres, urns, festoons, Greek fret, and fanciful animals. Mahogany was the chief wood. Furniture remained small.

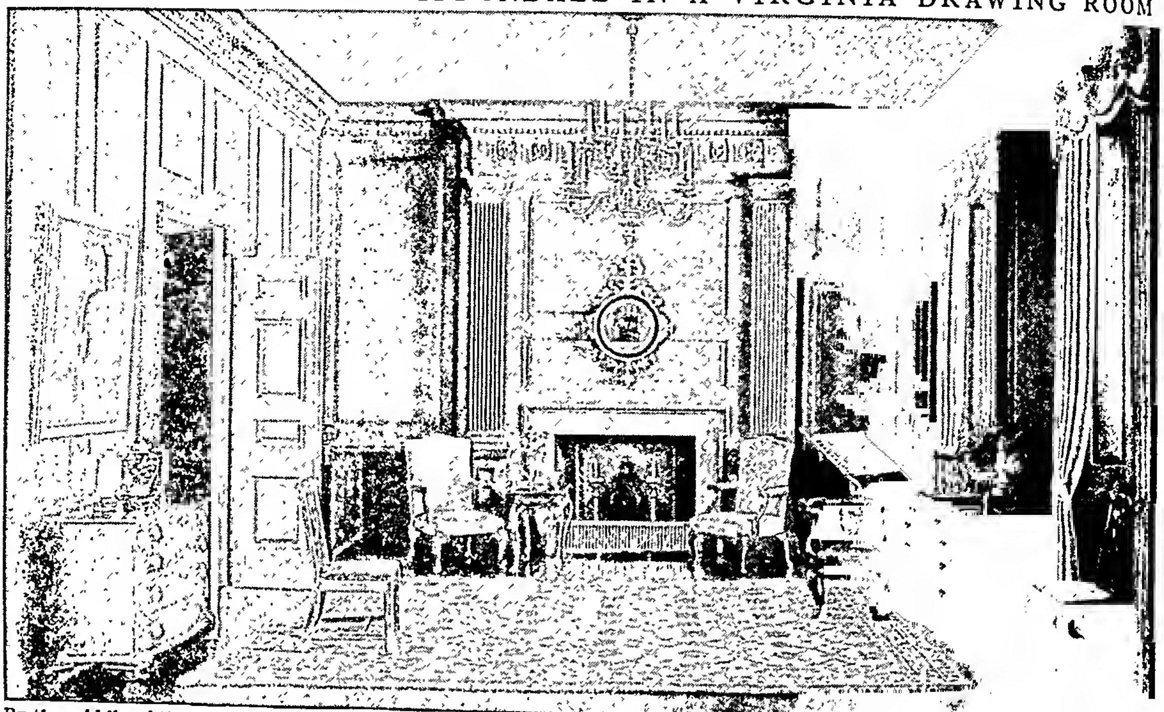
Cabinetmakers of the Empire period, with the influence of Napoleon I to back them, continued the classic revival. They copied Greek and Roman forms literally, as did cabinetmakers of the English Regency

EVOLUTION OF THE CABRIOLE LEG



These sketches show how designers gradually smoothed out the curves in scroll legs and so produced the cabriole. The legs dated 1670, 1680, and 1690 are scroll legs. The others, as well as those on the Queen Anne splat-back chair and lowboy, are cabriole legs.

"ENGLISH STYLE" CHIPPENDALE IN A VIRGINIA DRAWING ROOM



By the middle of the 18th century, wealthy southern planters were importing furnishings from England. This room is in a mansion built at Carter's Grove, Va., in 1751. The furniture has the best features of Chippendale's English style.

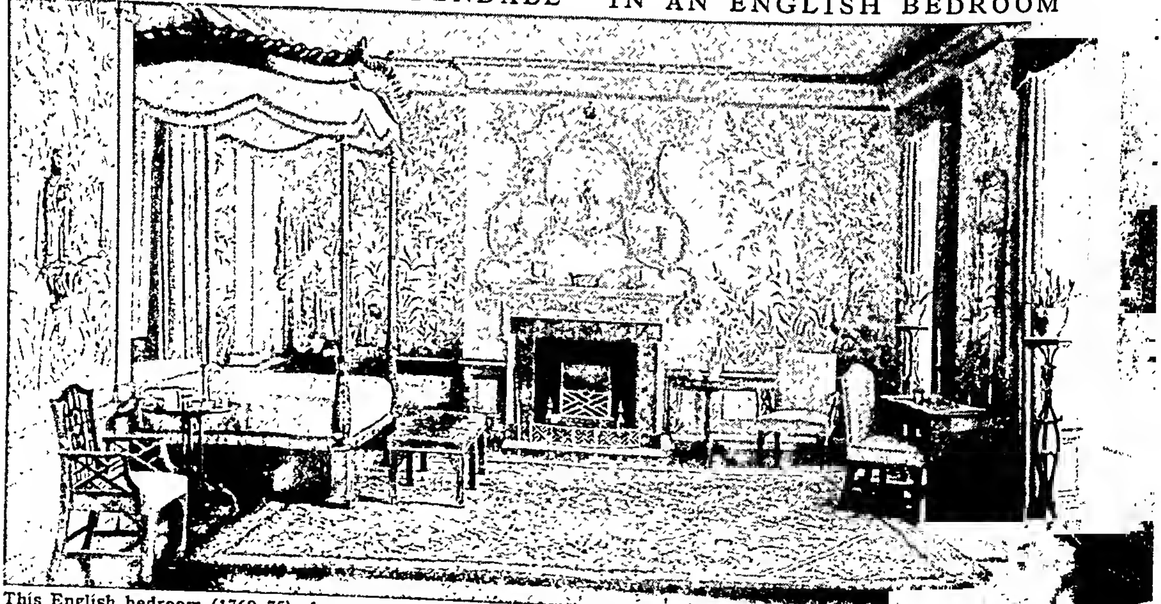
period. And, as in England, this period was followed by a further degeneration of the creative spirit due in part to the Industrial Revolution.

The court styles in their original splendor were important chiefly in Paris. Furniture was simpler in the provinces. There cabinetmakers adapted the graceful lines of Louis XV and XVI styles to produce informal, less-ornamented furniture. They used oak, beech, and fruit woods. Reproductions of this furniture are charming in small homes today. They combine well with Early American types.

Furniture in America

The styles known as Colonial or Early American began with furnishings imported from England and Europe during the 17th and 18th centuries. They include furnishings made in America of local

"CHINESE CHIPPENDALE" IN AN ENGLISH BEDROOM



This English bedroom (1760–75) shows all but the Gothic phase of Chippendale. His Chinese style predominates. For this style he borrowed from Chinese furniture the straight square leg and the type of fret used on the fire screen, chairs, and bench.

materials by local craftsmen. These men utilized designs of one or more European styles, particularly English from Jacobean through Georgian.

Early colonial imitations were usually simpler than the originals, with less ornamentation and cruder workmanship. Jacobean pieces were smaller to suit the smaller colonial homes. By the 18th century, American cabinetmakers had become more skillful and had better equipment. Following designs current in the mother country, they created furniture of beauty and distinction.

The years between the American Revolution and the Victorian age are known as the Federal period. Cabinetmakers worked under the influence mainly of Hepplewhite, Sheraton, and designers of the French Empire. Duncan Phyfe, of New York City, remains the best-known cabinetmaker of the period. His work showed the influence of Sheraton and the classic revival. Lyre-back chairs and pedestal tables with flaring concave legs were among his characteristic pieces. His furniture was graceful, finely proportioned, and decorated with exquisite carving. He used chiefly mahogany. A phase of the Federal period for a few years after the War of 1812 was the use of American eagles in the form both of ornaments and of structural supports.

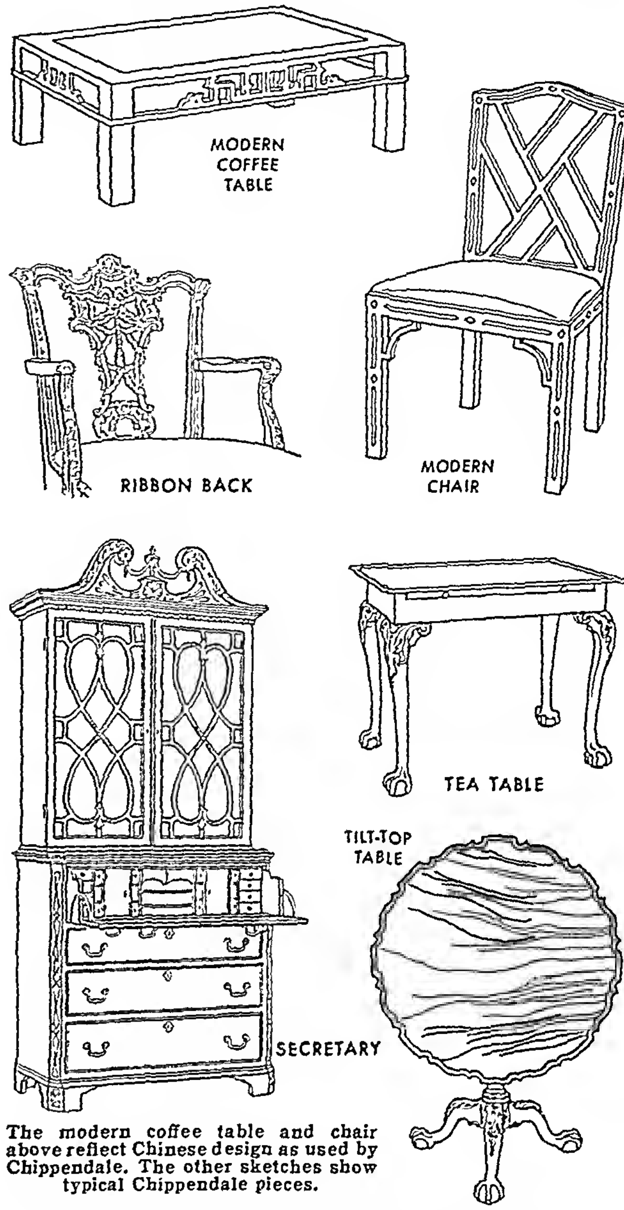
Utilitarian furniture in the colonies and in the young nation had more originality than formal types and often more charm. Windsor chairs reached a high point of development during the middle part of the 18th century. They were light, graceful, and comfortable. There were many variations, including chairs with *fan backs*, *wheel backs*, or *comb backs*, and *tablet chairs*, with a wide, flat armpiece suitable for writing. Ladder-back chairs also were popular. They appeared both as straight chairs and as rockers in sturdy, simple designs.

The rocker was distinctively American. Boston and Salem rockers made in the first part of the 19th century are collector's items today. The Boston rocker had a back made of slender spindles topped by a scrolled horizontal piece, spindled arms, and a wooden seat that curved up toward the back. The Salem rocker was similar but had a lower back.

The Victorian age followed the same pattern in the United States that it did in England. There was almost no creative vitality as machine production replaced hand methods (*see* Furniture).

About 1880 a phase known as *eclecticism* developed. This word comes from a Greek verb meaning "to choose." Historians of the arts use it to indicate that designers chose styles from other countries and other ages and copied or adapted them. The wealthy bought antiques or reproductions in French, Italian, Spanish, English, and German styles. Some imported and assembled entire rooms. Manufacturers in the early 1900's produced "mission furniture" in an attempt to imitate with machine methods the furniture built by hand in the Spanish missions of the Southwest. The Oriental influence introduced hassocks, ottomans, and Turkish divans with a profusion of

CHIPPENDALE'S WORK AND HIS INFLUENCE



The modern coffee table and chair above reflect Chinese design as used by Chippendale. The other sketches show typical Chippendale pieces.

cushions. Eclecticism is usually present in the arts. The Adam brothers were eclectic in their use of Greek and Roman designs. We are eclectic today in our use of period furniture. But in the so-called eclectic period in America the copying was indiscriminate and noncreative. The creative energy of the nation was flowing into other channels than art—expansion of the country, science, and industry.

The Modern Period—a Renaissance

A rebirth of the creative spirit in design brought furniture known today as "modern," "contemporary," or "international." The new furniture appeared more than 25 years earlier in Europe than in America. Yet the key to the period is the concept expressed by an American architect, Louis Sullivan of Chicago, that "form follows function."

In the best contemporary furniture the lines are simple. The design suits the use of the piece and the material of which it is made. Applied ornament

is rare. Beauty depends on line, the graining and finish of wood surfaces, texture and design in fabrics, color, and the complete suitability of each piece to its purpose and its position in the home. Bizarre pieces—neither beautiful nor useful—have appeared too often. They are, however, outside the main current of the contemporary movement, for they are not really functional.

Contemporary furniture, since it is without turning, carving, and other dust-catching ornament, is easily cared for. It is made in sizes and shapes to suit large and small homes. Usually it is easy to move. Sectional furniture is an important type.

The family who decides to buy modern furniture will avoid later dissatisfaction by making a leisurely choice, studying all types available. There are excellent American designers. European countries have developed national styles. Study of home-decoration magazines and books, furniture catalogs, and the furniture available in local stores develops discrimination. Careful study of individual pieces reveals whether the design will "wear well" and suit the home and whether the pieces are as functional as they are supposed to be.

The Fundamentals of Decorating

While considering what type of furniture to buy, the family may also be considering the fundamentals of decorating. Having these well in mind while making plans helps prevent mistakes.

No home can be furnished without color. The woods in furniture vary in color. Color appears in carpets, curtains, upholstery fabrics, paint, and wallpaper. From thousands of possibilities, the family has to select a color for each article in each room.

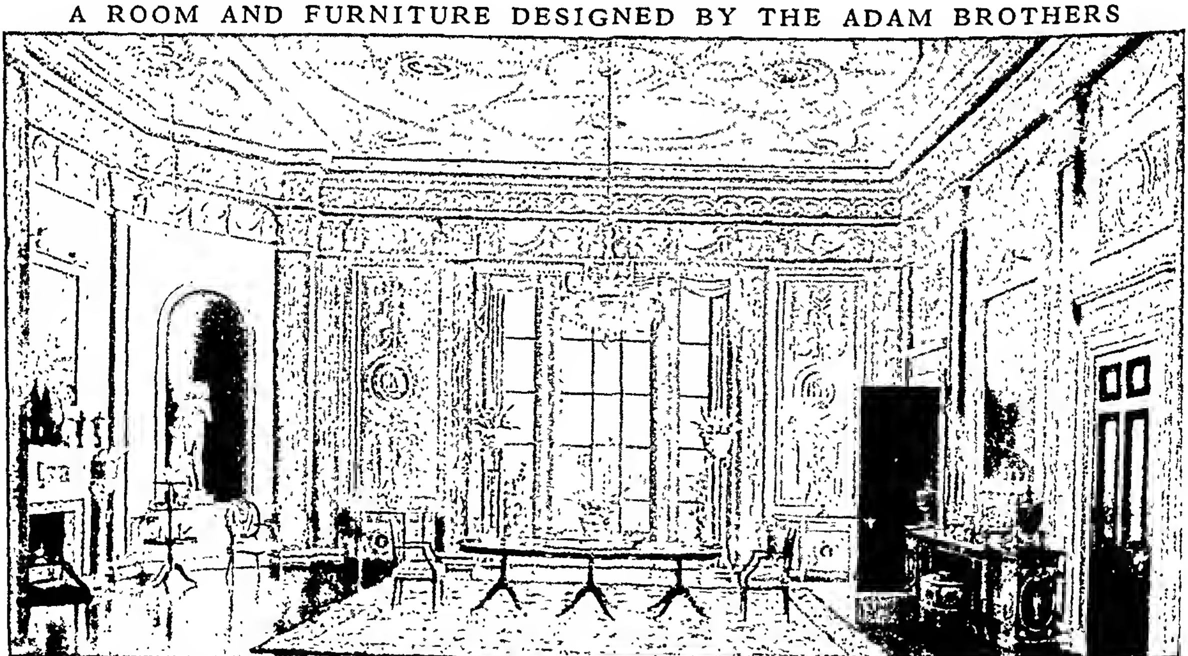
There are four major color plans. The *monochromatic* employs one color for all the larger areas (walls, woodwork, floors, draperies, and upholstery) and a sharply contrasting color for accessories. The *analogous* color plan uses closely related colors, such as green, yellow-green, and yellow, carefully distributed to achieve color balance. In the *complementary* scheme, the large areas are done in one color and the smaller ones, for accent, in its complement. Red-and-green rooms are in this category. The *triad* scheme employs three colors—blue, yellow, and red, for example—in unequal amounts. (*See also* Color.)

The use of "cool" and "warm" colors can make rooms appear larger or smaller or in better proportion. Cool colors are those containing blue or green; warm colors contain red or yellow. An intense cool color, however, may be "warmer" than a dull warm color. Cool colors seem to recede from the spectator and warm ones to come forward.

Walls and woodwork done in a cool color give a spacious appearance. Warm-colored walls make a room seem smaller and more intimate. If a room is too long for its width, the end walls may be painted in a warm color and the side walls in a cool color. The end walls will then advance and the side walls recede. The room will seem wider and not so long.

In choosing colors it is well to remember the effect of light. North light is colder than south light and usually calls for warm colors. In a sunny room, particularly one that is hot in summer, cool colors are restful. Colors change under artificial lights, especially fluorescent lights. They should be tested in the room where they are to be used, both by daylight and by artificial light.

A ROOM AND FURNITURE DESIGNED BY THE ADAM BROTHERS



For perfection of detail, few interiors can equal those created by the Adam brothers. They designed the house, the rooms, and all the furnishings to produce a harmonious whole. In this dining room, from a house built about 1775, low relief done in plaster and paint carry out classical motifs on walls and ceiling. The furniture is exquisite in its lightness and grace.

MIXED STYLES IN A CHARLESTON DRAWING ROOM

When this house was built, the people in Charleston, S.C., were more closely in touch with England than with the other colonies. Hepplewhite and Sheraton furniture in English and American types is shown here. The round drum table at the left has a Sheraton pedestal. American trade with the Orient at this period (1775–1800) introduced the Chinese rugs and porcelains.

The use of pattern in wallpapers, upholstery fabrics, slipcovers, and carpets often presents a problem. There may be more than one pattern in a room, but one should dominate. The wisest course may be to select only one pattern and then get variety by using several plain-colored materials in different values of one or more colors of the pattern. Texture in fabrics is important. One texture may dominate in the room, but some variation is needed.

The following are a few facts to remember about color. The nearer a background color approaches white, the more light there will be in the room. The same shade will seem darker in a rough than in a smooth texture. Large amounts of cool greens or blues in a room will balance small quantities of warm reds, oranges, or yellows. A dark color adds weight; a light one decreases it. For this reason, choice of color can disturb or correct the balance of an arrangement of furniture or ornaments.

The Use of Line

When two colors meet, they form a line. There are various types of line to consider—vertical, horizontal, curved, and diagonal. Straight lines are stronger but curved ones more interesting. Horizontal lines are more restful than vertical ones. Diagonal lines can cut a space badly. The amateur should avoid them. A circular line needs repetition unless it has a dominant position. If there is to be a circular coffee table, for example, in a room where all other furnishings are rectangular, a good-sized circular mirror or picture should hang somewhere in the room.

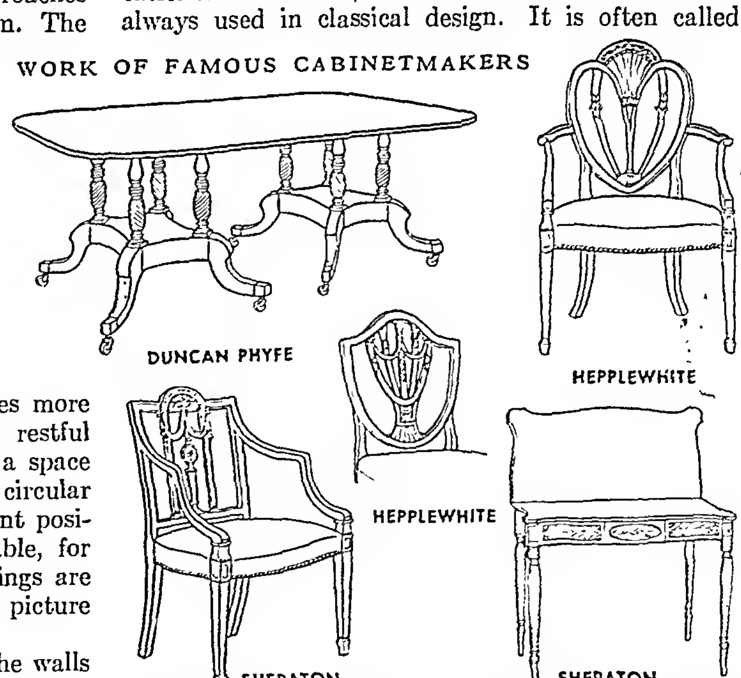
Draperies in a color that contrasts with the walls emphasize the vertical line if they are hung from ceiling to floor. This type of hanging makes low ceilings appear higher. Draperies hung from the top of the window to the sill, especially at a series of windows, emphasize the horizontal line. This is excellent if the ceilings are of normal height and the room needs width. Pictures hung row-fashion, up or down, may create horizontal or vertical lines.

Many lines in a room decrease the apparent amount of space. So it is usually wise to choose the same color for walls and woodwork in a small room.

Two Kinds of Balance

There are two types of balance, and both should be used in furnishing the home. The formal type is easier to understand, because it is more obvious. It is always used in classical design. It is often called

WORK OF FAMOUS CABINETMAKERS



Each design pictured above is typical of the well-known cabinetmaker whose name is shown with it. The Hepplewhite chair at the top has a heart-shaped back, and the other has a shield back. The Duncan Phyfe table is an extension dining table. The Sheraton table is a turn-up card table.

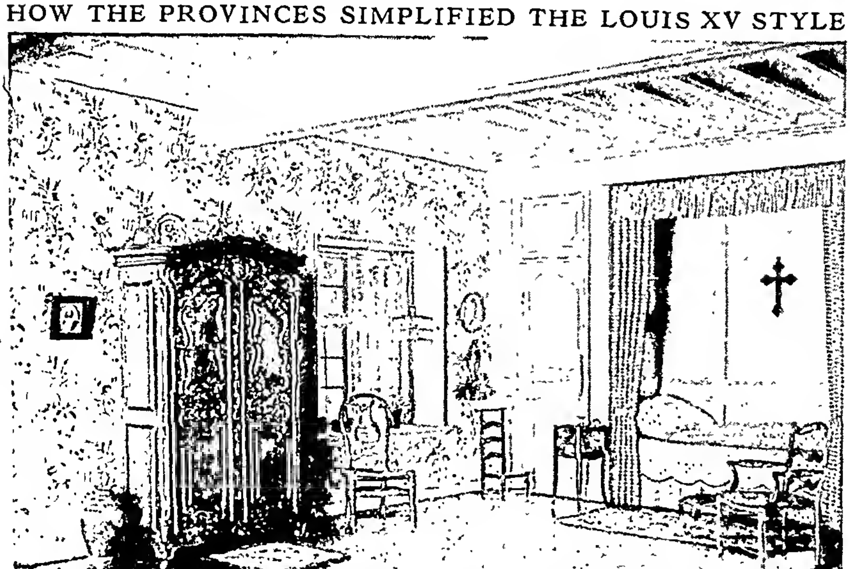
A FRENCH BOUDOIR IN THE ORNATE STYLE OF LOUIS XV

The room above shows decoration and furniture representing the middle part of the reign of Louis XV. The style of the period is at its height. All the lines are curved. The paint and plaster relief is more freely drawn than that of the Adam room on an earlier page. The chairs and sofa, with their comfortable upholstery, suggest the desire of the time for comfort as well as beauty.

"equal balance" because pairs of objects are placed in the same manner at equal distances from a central point. A pair of console tables, for example, may be placed at each side of an entrance door or a pair of bookcases on each side of a fireplace.

The second type is asymmetrical balance, or uneven balance. It is sometimes described as "optical balance." Large objects balance small ones when they are placed nearer the center than the small ones. A large bowl placed off-center on a mantel and a small bowl near the end create asymmetrical balance. Apparent not actual weight is the consideration.

HOW THE PROVINCES SIMPLIFIED THE LOUIS XV STYLE



This Normandy bedroom demonstrates the charm of furniture made in the French provinces during the reigns of Louis XV and XVI. Most of the furnishings are simplified versions of the Louis XV style. The lyre-back chair suggests the period of Louis XVI.

Furnishings must be considered in relation to the proportions of the human figure. It would be simple to say that furnishings should be small in a small room and large in a large room. But if furnishings are too small or too large for comfort they are useless. Only carefully selected essentials should appear in small rooms, and no one piece should dominate. In a large room it is better to fill the space with groups of furniture to serve various needs than to use overlarge individual pieces.

Every room needs one major and two or more minor centers of interest. These may be a fireplace, a picture window, or a special grouping of furniture. Spots of high color may be used in such centers without being repeated elsewhere in the room.

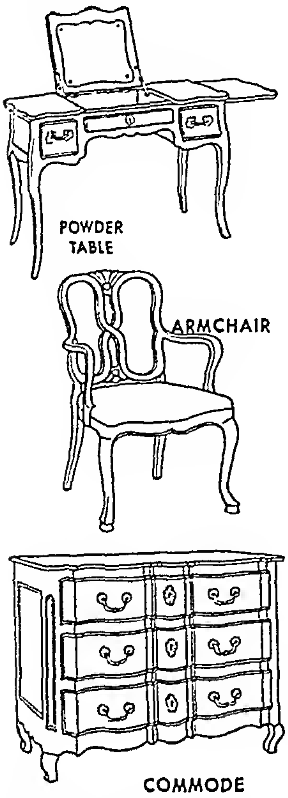
A cardinal principle of good decorating is that it is better to repeat something—a fabric, a color, a kind of chair—than to introduce too much variety.

Lighting the Home

Science has produced excellent types of lighting for the modern home. Lights concealed at the cove (the joining of ceiling and wall) and behind window cornices provide general illumination. Spot, panel, and tubular lighting provide local illumination. (*See also* Lighting.)

Lamps remain a convenience and a decoration. Each lamp must be related in scale to

FRENCH PROVINCIAL



The powder table and armchair are modern pieces designed in the French Provincial style. The commode is an authentic piece from the late 18th century.

the table on which it is to stand or the furniture group of which it is to be a part. The shade must have a wide enough spread to provide adequate light. A plain shade or a shade with a simple design, such as a border, is usually the wisest choice. More elaborate patterns may be introduced in one or two shades if the room is large and contains a number of lamps.

Drawing Up Plans

A necessary preliminary to buying the furnishings is to make an over-all plan. This should be minutely detailed in the case of each room. Family conclaves are a part of planning. They will determine how each room is to be used and who is to occupy each bedroom. Preferences in style, color, and arrangement should be discussed until everyone has had his or her say and all members of the family have reached an agreement or at least have arrived at a friendly compromise.

The plan for each room will list the articles wanted for that room and the color scheme. It will include a rough floor plan with measurements indicated. A notation as to height and width of windows is important. As furnishings are selected, their color, description, and price will be noted. This plan should always be taken on shopping expeditions.

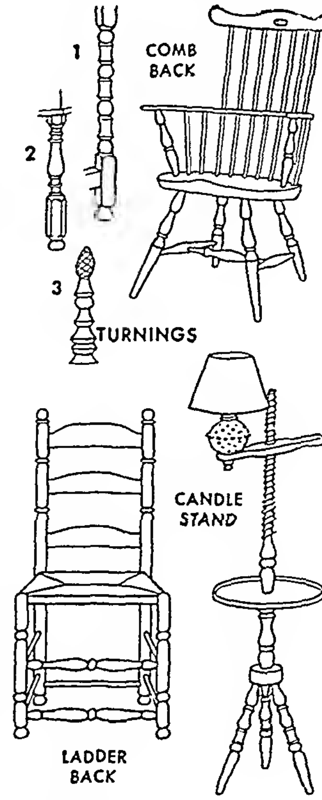
No matter how carefully a plan is made, it will be useless unless availability is considered. If the family buys drapery fabric and rug, for example, on the assumption that a certain wallpaper is available, and then cannot obtain the wallpaper, the plan becomes a muddle. It is only sensible to make sure that *all* important items in a decorating plan are available before making a decision to buy any of them.

Suggestions for a Budget

The furnishings for all rooms, including minor appliances and small cooking utensils, but excluding major appliances and built-in kitchen furniture, should cost a minimum of 20 per cent of the cost of the house or 20 per cent of the family income for five years. This amount should be prorated by rooms. The living room, dining room, and kitchen should take 60 per cent and the bedrooms 40 per cent unless there is an unusually large number of bedrooms. In that case there will be less money for the living room.

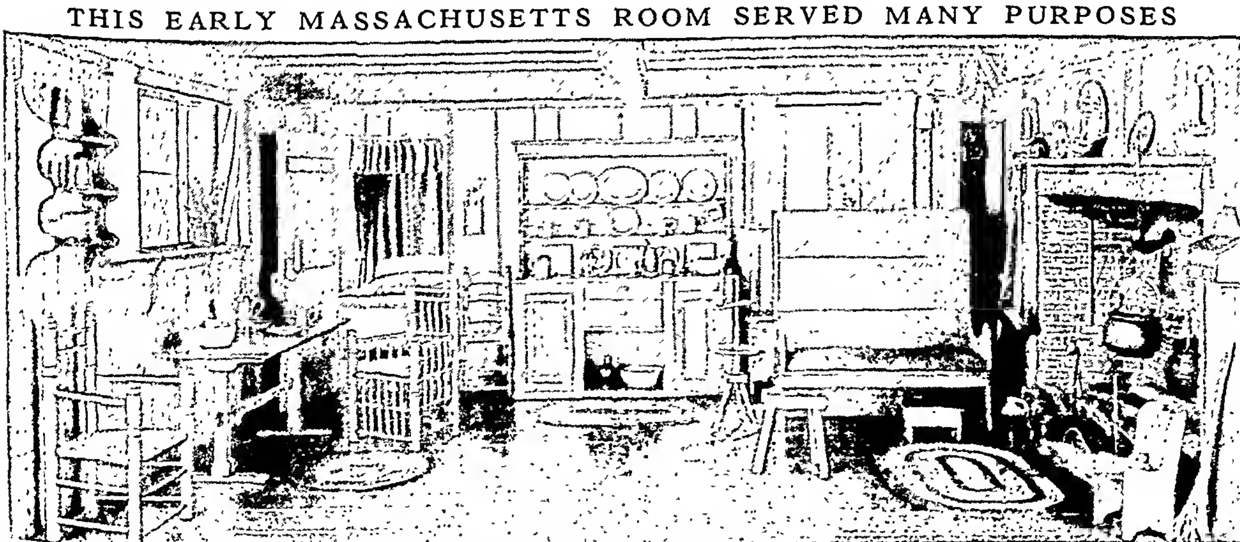
These figures are meant to serve only as guides. The resources and needs of families vary so greatly that there can be no unbreakable rules.

EARLY AMERICAN



These sketches show types in use today. The candle stand has been converted into a lamp. The turning is (1) ball and reel, (2) vase, and (3) pineapple.

THIS EARLY MASSACHUSETTS ROOM SERVED MANY PURPOSES



Rooms of this type served as living room, dining room, and kitchen in the colonies. Family life centered around the big fireplace. The furnishings were simply designed for utility. These are the Early American furnishings in favor today.

INTERNAL COMBUSTION ENGINE. When a fire burns, it gives off hot gases. In open air the gases can expand and escape freely. If the fire burns in a small enclosed container, the expanding gases will push against the walls with explosive force. This force is put to useful work in the *internal combustion engine* (also called a *gas* engine). It can be used to push a piston or turn the blades of a turbine and thus supply power for all sorts of tasks.

The engine is called "internal combustion" because the burning (combustion) takes place inside. This feature distinguishes these engines from those run by steam. Fuel for a steam engine is burned in a separate boiler.

Almost any fuel will serve to generate the gases. The most widely used fuels are petroleum products in liquid or gas form (*see* Petroleum). Other fuels such as alcohol and charcoal gas have been used successfully. The fuel must be mixed with an added quantity of air before burning. The extra oxygen gives hotter gases, and they expand with greater force. Mixing may take place in the combustion chamber itself, or outside, in a carburetor. The burning may be started by an electric spark or by injecting fuel into hot compressed air in the combustion chamber.

One of the most useful gas engines is the Diesel, used for powering ships, electric generators, and farm and construction machinery (*see* Diesel Engine). A simple two-stroke cycle is preferred for such uses as the outboard motor and the power lawnmower (*see* Motor). But the most widely used is the Otto four-stroke cycle engine. It provides power for automobiles, aircraft, and many stationary machines. The article Automobile explains this engine and shows a diagram of its operation.

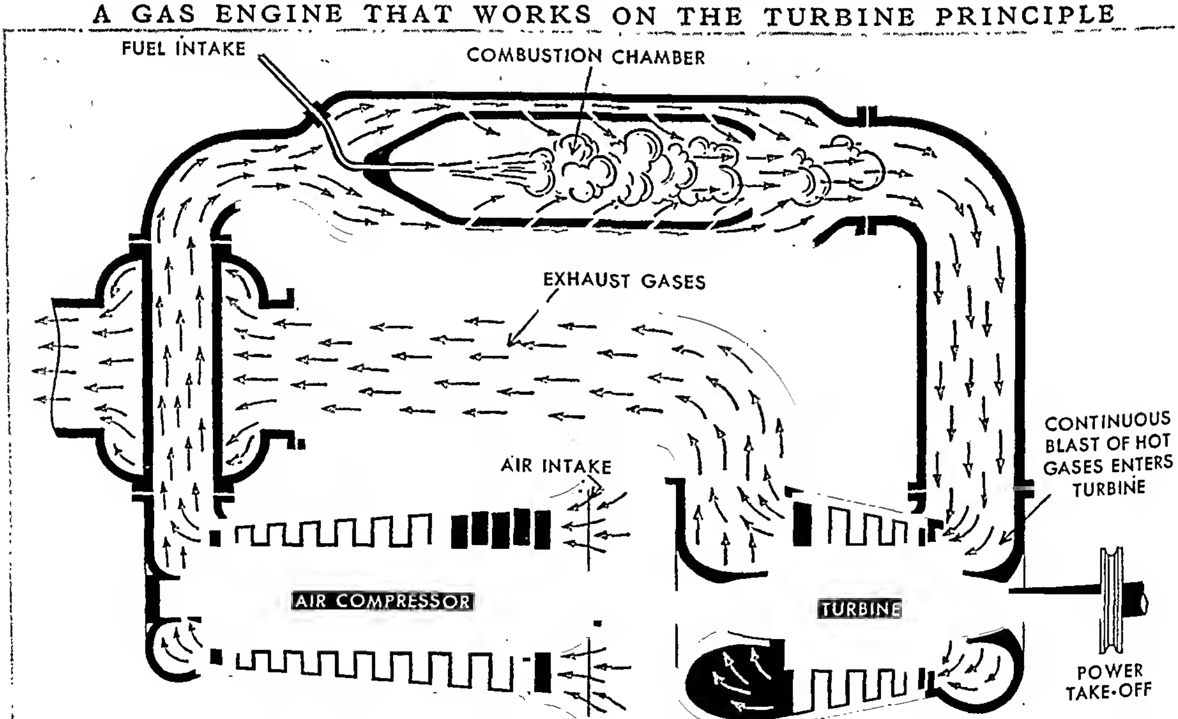
In all these engines, the combustion chamber is a cylinder, and the expanding gases push against a piston. The moving piston, through a connecting rod, transmits power to a crankshaft. Gas *turbines* employ the working principle shown in the picture below. The gases push against the turbine blades, and the revolving turbine turns a power shaft. This principle is used in some engines for jet aircraft (*see* Jet Propulsion).

Early History of the Engine

No one man can be called the inventor of the internal combustion engine. The first steps were taken in the late 17th century, when scientists experimented with gun powder in "explosion" engines. These had no practical results. In 1791 an Englishman, John Barber, took out a patent on a turbine run by illuminating gas. In 1794 Robert Street used the explosions of turpentine vapor to drive a piston. But it was not until 1860 that Étienne Lenoir, a Frenchman, invented a practical gas engine.

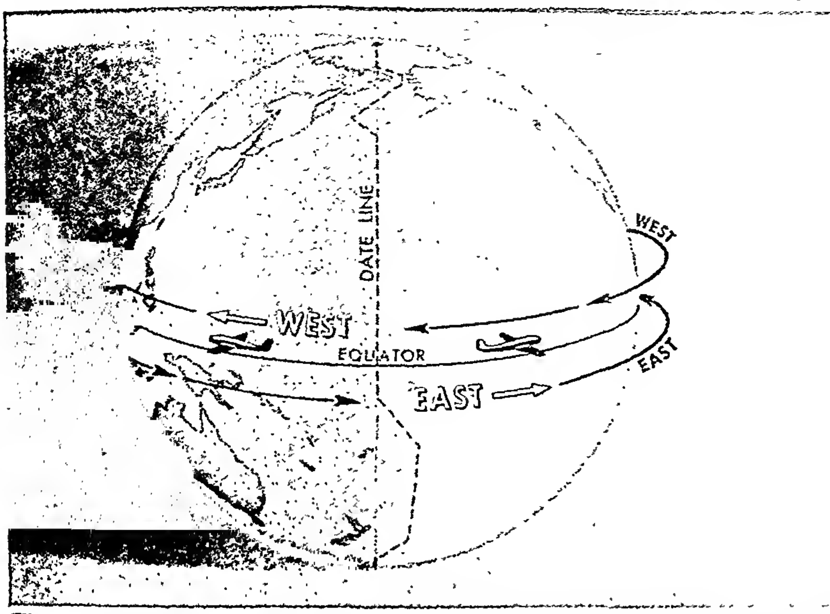
The four-stroke cycle engine was invented by Dr. Nicholas A. Otto, of Cologne, Germany. In 1878 he worked out the design which makes possible today's swift vehicles. In 1892 Rudolf Diesel, another German, invented the engine which bears his name.

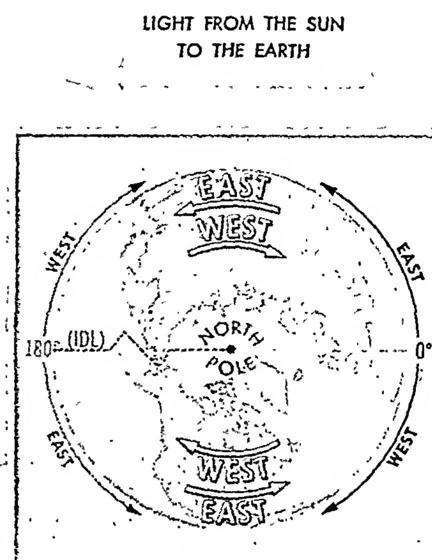
A GAS ENGINE THAT WORKS ON THE TURBINE PRINCIPLE



The inventor's dream of an engine in which the gases push directly against the rotating part was finally realized in the gas turbine developed in 1940–42 and illustrated here. It resembles the steam turbine in its operation (*see* Turbine), except that it has an air compressor attached to the turbine shaft which feeds a swift blast of air to the combustion chamber. There the fuel is injected and takes fire. The blast passes through the turbine, whirling its rotor like a hurricane spinning a windmill. Then the exhausted gases pass out of the engine, sweeping around the intake pipe to preheat the incoming air.

The DATE LINE *Where* DAYS *Are* GAINED *or* LOST





When a traveler on a trip around the world crosses the Pacific Ocean, he gains or loses a day at the international date line (IDL). To see why this happens, imagine yourself out in space, watching an airplane as it flies along the equator. In the *polar view* (at right), it is important to understand directions around the earth. West is always *clockwise* (the direction a clock's hands move). East is *counterclockwise.*

INTERNATIONAL DATE LINE. When a plane flies east or west around the world, its passengers find on their return that they have gained or lost a day. Even if travelers only cross the Pacific Ocean, they gain or lose a day in the passage.

To understand what happens, imagine a traveler crossing the Pacific from the United States to Asia. On a Tuesday afternoon when he is about halfway across, it is suddenly Wednesday. He has "lost" the remainder of Tuesday and part of Wednesday, or one day in all.

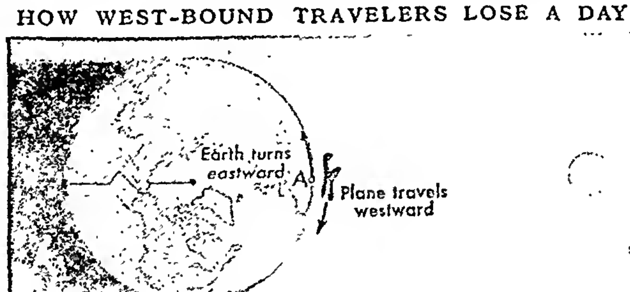
Now suppose another traveler is crossing in the opposite direction at the same time. For him the day has been Wednesday, but about halfway across the ocean it becomes Tuesday. He has "gained" a day on the calendar.

This gain or loss is needed to adjust for the effect of travel on the count of days. A complete day (a date in the calendar) runs from one midnight to the next. In this time, the earth makes one eastward turn on its axis, while sun and stars appear to wheel westward (*see* Astronomy).

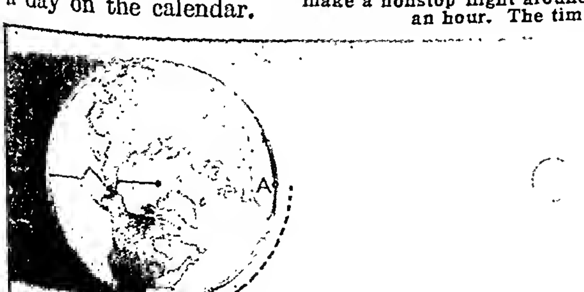
When people stay home, the days follow each other at 24-hour intervals. But if a man travels west, the sun will not "get ahead of him" as fast as usual in its apparent motion. More time will pass before the new date comes. For a trip around the world, this lag will amount to a full day, as shown in the pictures on this page.

If a traveler goes east, he and the sun pull apart *faster* than usual. Hence midnight and a new date come sooner than they

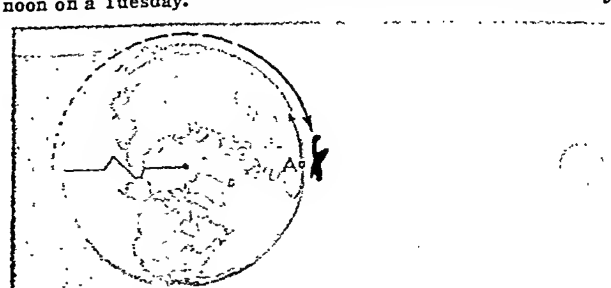
HOW WEST-BOUND TRAVELERS LOSE A DAY



1. In this polar view, an airplane is starting to fly west along the equator from an airport at the point marked *A.* It is going to make a nonstop flight around the world at a speed of 500 miles an hour. The time is noon on a Tuesday.

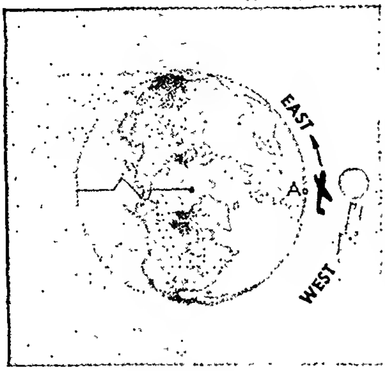


2. One day (24 hours) later, the earth has turned once on its axis. For people at A, the time is again noon, and the day is Wednesday. But the plane is now halfway around the world, under a midnight sky. For its passengers, only half a day has passed.

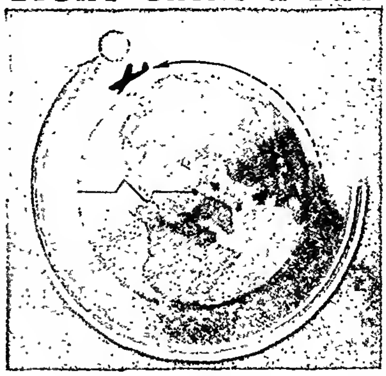


3. When it is noon Thursday at A, 24 hours later, the plane finishes its flight. For those who stayed at home, two days have passed. But *the travelers' count of day and night shows only one day,* from noon to noon. They have "lost a day" in their count.

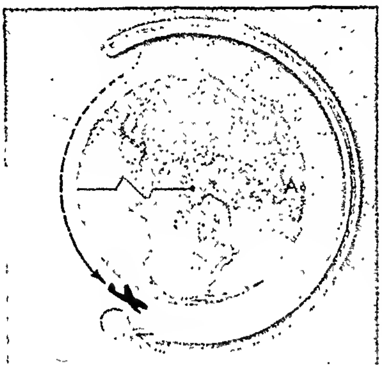
WHY AN EASTWARD FLIGHT GAINS A DAY



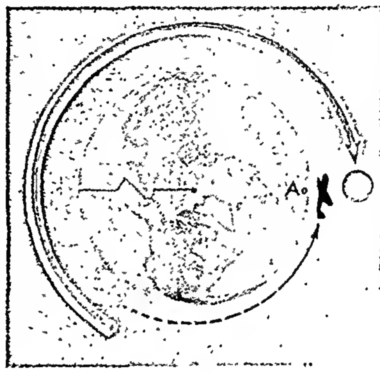
1. Here the plane shown on the preceding page starts around the world again at the same speed (500 miles an hour). But this time it heads *east*. What happens now can be seen most easily if we imagine the sun going around the earth, as it appears to do. The plane and the sun are moving in opposite directions, but will meet on the farther side of the globe. Their combined speeds will determine where.



2. The sun is moving twice as fast as the plane. A little figuring will show that the plane passes under the sun after 16 hours of flying. In this time it has gone one-third of the way around the earth, while the sun has gone two-thirds of the way. At this moment, it is noon again for the passengers. The sun is overhead though they have been flying only 16 hours, as they can tell by consulting their watches.



3. Sixteen hours later (32 hours after the start), the plane is two-thirds of the way around the world, and it passes under the sun again. So for the passengers, two days, measured from one noon sun to the next, have passed, though their watches show that only 32 hours have elapsed. But since days are counted from noon to noon or midnight to midnight, they call the second 16 hours another full day.



4. In another 16 hours, or 48 hours after the start, the plane completes its flight. Once again the sun is overhead. For the passengers, *three* days (from noon sun to noon sun) have passed, though the flight has actually taken only two days (48 hours). So they find that their calendars are one day ahead. In other words, they find that by traveling eastward around the world they have "gained a day."

would at home. A traveler going around the world will *gain* a day as shown above.

Somewhere along his journey, the westbound traveler must drop one from his count of days, in order to catch up with the calendar. The eastbound traveler must use the same date twice to allow for the day he has gained. The custom is to make these adjustments about halfway across the Pacific Ocean. There they cause the least confusion.

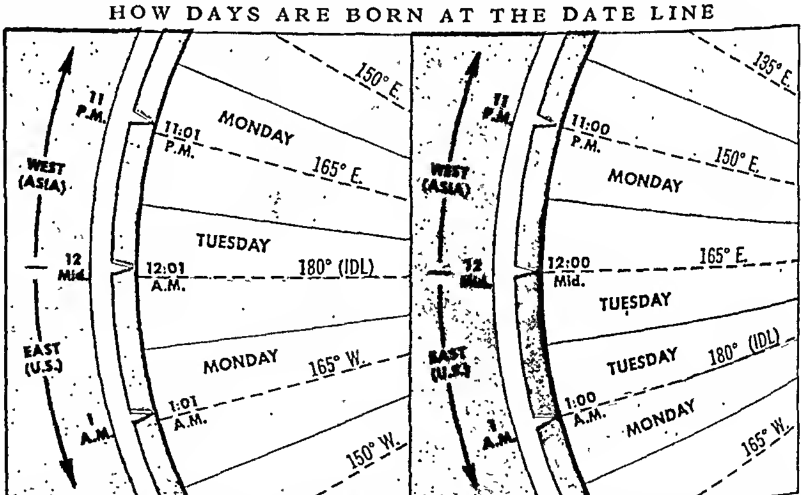
The "marker" for the change is the 180th meridian (*see* Latitude and Longitude). Therefore this meridian is called the *international date line*. The line swerves east or west of the meridian, however, to avoid cutting through island groups. This allows all the islanders to use the same date.

This date line also helps to keep dates straight in all parts of the world. The need for help arises from the way new dates are "born" at midnight in any locality. To simplify timekeeping, modern nations divide the earth into 24 north-south zones of standard time (*see* Time). So a new date is born every hour, when the time at the central meridian of a time zone is midnight.

If nothing more were done, nobody could say which "birth" should be used to start a date for the world. Selecting the one at the 180th meridian settles this problem. The new date comes into being in only the western half of this zone; so travelers change dates when they cross the central meridian of the zone.

The exact course of the date line has never been fixed by international agreement. Hence maps may show details differently, provided the line passes between certain island groups according to the dates they observe. (For maps, *see* Pacific Ocean; Time.)

HOW DAYS ARE BORN AT THE DATE LINE



These polar-view diagrams show the standard time zones near the 180th meridian, or international date line (IDL). Figures show the central meridians of each zone. The time scale, shown in white, is fixed in space; the earth is turning eastward. When the 180th meridian is exactly at the midnight position, the new day is born, but only in the western half of this zone. The left-hand diagram shows this new day as one minute old. In 59 minutes more (right-hand diagram), rotation has carried the time zone of 165° E. to the midnight position and the new day is born again there. This continues hour after hour until the date line is again at the midnight position. Then another new day comes into being.

RULES *and* CUSTOMS *that* PREVAIL *between* NATIONS

INTERNATIONAL LAW. The body of rules and customs by which sovereign states are guided in their relations with each other is called international law. It is based only on mutual consent of sovereign states, and it is effective either because the nations of the world recognize that it is to their best interests to accept it, or because stronger nations are able to force their point of view upon weaker ones.

Generally, in ancient and medieval times, international relations were regulated by special treaties between rulers. Among the city-states of ancient Greece there were a few principles of international procedure, such as the protection of ambassadors, but there was no body of recognized law.

The medieval Italian city-states were the first group to work out a code comparable to modern international law. Those city-states were near neighbors, closely allied in blood, bitter rivals in commerce, and often quarreling over religious matters. Out of this situation a few wise rulers developed a system of passports, established the distinction between armies and civilians in war, and set rules for warfare.

Grotius' Great Book

In northern Europe, however, international relations were still based on the right of the mighty to have their way. In opposition to this theory Hugo Grotius, a Dutch jurist, wrote the book 'De jure belli ac pacis' (Of the Law of War and Peace), published in 1625, which is the cornerstone of international law. Grotius laid down the following principles, to which later jurists and philosophers have added but little: (1) War should be carried on only for a just cause, and for the purpose of defense. (2) Do no more injury to the vanquished than is strictly necessary. (3) Force alone ought not to regulate the relations of peoples, for there is justice between states as well as between individuals. (4) To observe treaties is the wisest practise and the greatest strength of sovereigns.

The rules and principles of international law are obligatory. Incomplete enforcement and occasional violation of it are not regarded by other nations as destroying its status or legal obligation. It is no defense for a nation to point out that its own laws or constitution permit actions which other nations consider a violation of international law.

How International Law is Made

International law is formed by the mutual consent of nations, given either by international practise or by treaty agreement (*see* Treaties). Such practises and agreements may involve only two nations (bi-lateral agreements) or they may extend to many nations (multi-lateral agreements).

Each nation may decide how it shall act to secure respect for its rights under international law. For example, if a nation believes that fishermen of another nation are invading its own fishing grounds, the question may first be discussed by diplomatic representatives. If settlement is not possible in this way, the question at issue may be referred to an arbitration commission (*see* Arbitration).

In the use of force to redress injuries received, a nation is limited to action proportionate to the original offense. Such action is called *reprisal.* A threat of immediate injury, such as a bandit raid across the frontier, may be met directly by the limited use of force to remove the danger, or indirectly by pressure upon the offending nation. Such pressure or *intervention* in the internal affairs of another sovereign state was formerly regarded as illegal, but is now generally accepted as necessary, especially when the interests of a powerful state are endangered by disorder in a neighboring weaker one.

A nation, to be recognized as such by other nations, must be independent of foreign control and must be willing to live according to international law. Formal, or *de jure*, recognition of a nation is irrevocable, and continues in effect notwithstanding changes of territory, population, and social or political organization, unless the changes destroy the identity of the nation. Thus loss of a large part of its territory after the first World War did not destroy the identity of Turkey; but Austria-Hungary did cease to exist as a nation. Belligerent groups and *de facto* governments, that is, governments actually in power but without full legal authority, may be recognized as such and enjoy a limited status until they give evidence of stability and intent to observe international law.

Meaning of National Jurisdiction

A nation possesses supreme authority or sovereignty, called *jurisdiction,* over all territory, things, and persons within its boundaries. It may also exercise jurisdiction over its own property and its *nationals* and their property in foreign jurisdictions, subject to the jurisdiction of other nations as set forth in international law or treaties. (*See* Citizenship; Naturalization.)

Sometimes powerful nations maintain *extraterritorial jurisdiction* in backward countries or countries lacking a stable government. These rights, secured by treaties called *capitulations*, exempt a nation's citizens from control of local courts in countries granting the capitulations; instead their legal disputes, often even criminal charges, are adjudicated by a representative of their own country, such as an ambassador, minister, or consul.

Exempt from the local jurisdiction of any nation are foreign nations as such, their officials, chiefs of state, diplomatic and consular representatives, military personnel, and their property (*see* Diplomatic Service). One nation may not be sued in the courts of a second, nor may legal action be taken against its officials or its property.

Any nation may exercise jurisdiction over persons actually engaged in *piracy* (*see* Pirates and Piracy). This does not, however, authorize the halting, for purposes of inspection, or *visit and search*, of alien

vessels in time of peace unless they are reasonably suspected of being engaged in piracy. Alien vessels beyond the marginal belt of a nation may not be seized for exercise of local jurisdiction unless they have made contact with the shore with intent to injure that nation or violate its laws.

How Nations Gain Territory

A nation may acquire territory by discovery, by purchase, by long continued occupation or by *cession* from another nation. Increases in the territory of a nation by processes of nature, or *accretion*, as in the case of shifting sands making new land, belong to that nation. If boundaries between nations run through bodies of water, such as rivers or straits, they usually follow the middle of the main channel or the middle of the stream, measured from low-water mark. When territory is transferred from one nation to another, private property rights are not affected.

Specific rights of sovereignty may be given up by treaty; if a nation surrenders its right to make war it becomes *neutral*, and if it gives up its right to exclude aliens it is *internationalized*. Other sovereign rights are not affected.

A *littoral* nation, that is one with shore lines, exercises jurisdiction over all lakes and rivers or canals entirely surrounded by its territory, over gulfs which enter the sea by mouths not over six miles in width, and also over the *marginal belt* of the nation along the open coast. This marginal belt extends from low-water mark on shore to an imaginary line three miles seaward—once the maximum range of cannon. Sometimes nations claim wider marginal belts (also called "territorial waters"), but the general rule is not changed. A nation may not close its ports to all alien vessels or prevent "innocent navigation" of its marginal belt by vessels with no harmful intent. Such courteous practises make up the *comity of nations*.

Reservation of Sovereignty

Rights of use and exclusion over territory, adjacent waters, and air, may be transferred from one nation to another by lease or *servitude*, with reservation of final sovereignty. A nation gains rights of use and exclusion, but not full sovereignty, over territory of another nation which it occupies by military force.

A nation may demand the surrender by another nation of territory, things, or persons only on the basis of general law or treaty agreement. It may demand the *extradition*, or surrender of fugitives from justice, only on the basis of a treaty. Extradition is not ordinarily granted for political offenses. Each nation may claim for its nationals the right to travel and trade in the territories of another.

Rules of War

War may not be started without declaration to the enemy and notice to neutrals, though acts permissible only in a state of war, such as *blockade*, bring war into existence even in absence of a declaration. In war, troops must be placed under effective control of national officers, and must be designated by uniforms, flags, or other distinctive marks. Neither poison nor explosive bullets nor any weapon that causes unnecessary suffering may be used. A *belligerent*, any nation engaged in war, may bar access by sea to the ports of the enemy (*see* Blockade). Religious, philanthropic, educational, artistic, or scientific property of the enemy is exempt from seizure or injury, as well as medical establishments connected with fighting forces. Similarly a mission bearing a white flag, the flag of truce, or giving other adequate signs of intention, may not be attacked or captured. Private property on land may only be *requisitioned*, that is, formally claimed for use, subject to compensation.

Enemy combatants may be captured or rendered incapable of further action, *hors de combat*, by armed forces when encountered in national or enemy territory. But other persons, *non-combatants*, may not be molested unless they use force against the national forces openly, and thus become *combatants*, or secretly, *snipers*. At the outbreak of war, enemy aliens may be expelled from the national territory, interned, or deprived of civil rights. A belligerent may send spies secretly or in disguise into the area of operation of the enemy. A person captured under suspicion of being an enemy spy must be given a military trial and may be punished by death if found guilty.

Treatment of Prisoners

Prisoners of war must be protected in their persons and private property. They may not be imprisoned beyond necessity for safety or discipline, and may not be forced to render military service, though they may be compelled, officers excepted, to render other services at rates of pay prevailing in the locality. They may be discharged on parole with the consent of their own nation. Each belligerent is responsible for the sick and wounded found in his area of operations; these must be given adequate medical care. The dead must be given burial or incineration after identification; lists of prisoners and dead must be transmitted to the enemy from time to time.

Either belligerent may continue hostilities until they are ended by agreement, namely by *truce*, *armistice*, or *treaty of peace*, but continued cessation of fighting by one belligerent may be regarded as ending war, and so surrendering its territory but not its full sovereignty to a military occupant.

Obligations of Neutrals

In time of war between two nations all other nations may remain neutral, at peace with both parties. A belligerent is forbidden to make use of neutral territory. Belligerent forces and material, including war vessels and prizes overstaying the period allowed by law, found in neutral territory are to be interned. A neutral nation is under obligation to enforce its rights against both belligerents and to abstain from aiding either or both. But individual nationals of a neutral nation may engage in transactions with any belligerent government, such as loans of money or sales of ammunition or other supplies.

Belligerent war vessels and prizes may remain in neutral waters or ports only 24 hours unless unsea-

worthy, or on account of bad weather or shortage of supplies. They may secure repairs and supplies enabling them to reach a home port. Only three vessels of one belligerent nation may remain together in a neutral port; if war vessels of opposing belligerents arrive in the same port, they must leave in order of arrival at intervals of 24 hours.

Rights of Neutrals

Private enemy property at sea may be captured unless sailing under a neutral flag, but only after visit and search to determine its liability; resistance lays the vessel open to destruction. Captured property must be taken into port for settlement in a *prize court,* unless necessity, as in capture by a submarine, requires destruction of the prize. In that case, all persons on board the prize and the ship's papers must first be placed in safety.

Freedom of the seas, the right of neutrals to carry on shipping unmolested during a war, is an important principle of international law. Neutral vessels in belligerent ports are liable to requisition, with compensation, for transport service. Vessels at sea are open to visit and search to determine their liability to capture for breach of blockade, carriage of war materials, called *contraband,* or participation in hostilities, *unneutral service.* If contraband goods are shipped to a neutral, and then sent across the border to a belligerent, or if they are passed through a blockade, the method is called a *continuous voyage.* Neutral prizes may be destroyed under the same rules applying to belligerent prizes.

After the middle of the 19th century international law grew greatly in scope and influence. The nations also set forth existing law in systematic form, called *codification.* This work was carried forward in the 1930's by the League of Nations. In 1945 the task passed to the United Nations.

Broadening the Scope of World Law

The United Nations charter states that one of the main purposes of the United Nations is the settlement of international disputes "in conformity with the principles of justice and international law." It sets up the International Court of Justice. And it authorizes the General Assembly to encourage the development of international law and its codification. By its emphasis on "human rights," the charter extends the scope of international law to individuals.

To carry out the *human rights* provisions of the charter, the General Assembly set up a commission to draft an international Covenant of Human Rights. In 1948 the Assembly adopted a Convention on Genocide, which makes the destruction of a people an international crime. (Covenants and conventions are not binding until adopted by member states.) The trials of war criminals in Germany and Japan were another extension of international law to individuals (*see* Germany; Japan; World War, Second).

The International Law Commission, created by the General Assembly, began in 1949 to draw up plans for the development and codification of international law. (*See also* Hague Peace Conferences; Peace Movement; Red Cross; League of Nations; United Nations.)

How NATIONS *of the* WORLD TRADE *with* ONE ANOTHER

INTERNATIONAL TRADE. If you had coffee or hot chocolate or bananas on your breakfast table today, if there was an aluminum cooking utensil on your stove, if you washed the dishes with soap, you benefited from international trade. The coffee and bananas came from Latin American countries, the chocolate from Africa's Gold Coast, the aluminum from bauxite mined probably in Europe or Canada or Surinam, and the oil in the soap from coconuts grown on Pacific islands. Every day you use many other articles from foreign lands.

You also use a great number of things which were made in your own country from raw materials that were imported. Many of our great factories would have to shut down if they were forced to do without materials from other lands. Into the manufacture of our automobiles goes cork from Algeria or Portugal, tin from Malaya or Bolivia, chromium from Rhodesia, shellac from India, long-staple cotton from Egypt. Manufacturers of tires, telephones, electric wiring, radios, and a thousand other things necessary to our everyday life need rubber from tropical lands. Vanadium from the Andes of Peru is combined with American steel to make a tough strong alloy that is necessary for our locomotives. United States manufacturers need Canada's nickel for rails, bridges, ordnance, and many parts of automobiles; they need tungsten and antimony from China, manganese from Russia, and tin from the East Indies for a hundred and one articles, from tooth-paste tubes to industrial machinery.

These countries, because of differences in climate or in natural resources, have mineral or vegetable products that America lacks and needs. America likewise has products that other countries cannot supply for themselves. This, then, is a basic reason for international trade—that countries may procure necessities or luxuries that they cannot produce themselves.

Specialization and International Trade

But, you may point out, nations buy from other nations things that they *could* produce themselves. The United States could and does grow sugar. Why, then, does it import a great quantity of sugar from Cuba? The answer to that question brings out a second basic reason for international trade. We live today in an exchange civilization, which is based on *specialization,* or *division of labor.* We, as individuals, each do one particular kind of work and use the money we earn to buy from others the things we need. In this way we can enjoy many more things than we could if each of us had to produce everything that he uses. The same is true of countries. Each country specializes in the things it can produce most advantageously, and *by exchanging its products with other countries*

it obtains a larger quantity and a greater variety of goods than it could produce for itself. Sugar can be grown much more cheaply in Cuba than in the United States. But the United States can manufacture iron and steel products and machinery more cheaply than Cuba. It is economical, therefore, for the United States to sell these products to Cuba, and to use the money received for them to buy Cuba's sugar.

Sometimes it may even be profitable for a country to import a commodity which it could produce more cheaply than the country from which it buys, because there are other commodities which it can produce still more advantageously. The United States, for example, could grow flax for fiber more cheaply than Ireland or Germany, but it may be better for the United States to grow the crops for which it has an even greater advantage, such as wheat and cotton, and to buy its flax and linen. This is an example of what economists call *the law of comparative costs:* A nation tends to specialize in the production of those commodities which yield the greatest returns and to import those in which its advantage is not so great.

Specialization Increases Interdependence

As countries specialize to a greater and greater extent, they produce much larger quantities of their special products than they can use at home. They therefore become increasingly dependent on foreign markets to buy their surplus, as well as on foreign imports of the commodities they do not produce. Most primitive peoples, as we know, produce all the things they use; but their standard of living is low, and they get along with only the barest necessities of food, clothing, and shelter. Pioneers in new countries, such as the American colonists, produce a large proportion of the things they need; but they soon begin to establish the industries for which the country is best adapted and to send their products to the older countries in exchange for things that will make their lives more comfortable. Thus international trade makes it possible for nations to develop their resources, build up their industries, and, by producing special products in large quantities, to lower the costs of production.

Countries, such as England, with a large population, a small area of arable land, and good facilities for manufacturing, tend to become highly industrialized and to import their foods and many raw materials. Other countries, such as Brazil, Argentina, and other South American republics, develop into agricultural and raw material nations, exchanging the products of their farms, forests, and mines for the manufactured products of the industrial nations. The United States has developed into an industrial nation, but, because of its vast area and rich natural resources, it continues to produce a surplus of raw materials and foodstuffs which make up about a third of its exports.

Industrial nations not only trade with raw material nations, but they also do a great deal of trading among themselves. European industrial countries, we are told, do more trading with one another than they do with agricultural countries. They also buy three-fifths of the manufactured articles exported by the United States. Specialization, of course, is the reason for this. Natural resources, character of the country, climate, labor conditions, special aptitudes of the population, and other factors may help to determine what products a country shall specialize in.

Look at the major exports of various countries and you will see how each one tends to specialize. Brazil is the largest exporter of coffee in the world. India supplies much of the tea that the world drinks and also a large part of the world's jute. Holland's cheese and Denmark's dairy products have widespread markets. Switzerland's fine watches are known the world over. And many countries depend on industrial machinery made in the United States.

Foreign Trade: Its Meaning and Its Value

We have been using the term *international trade* for trade between nations. The trade of each individual nation with other nations is called its *foreign trade.* The total amount of a nation's foreign trade in merchandise is the amount of the goods it buys, or *imports,* plus the amount of the things it sells, or *exports.* The buying and selling are, of course, done chiefly by individual merchants or firms and only to a small extent by governments.

The following table gives the value of the *per capita* foreign trade of some leading countries before the second World War. The greater the trade per capita, the greater is the country's specialization:

Per Capita Foreign Trade	*1939*
Denmark	$179
Switzerland	171
Netherlands	152
Great Britain	129
Germany (1938)	63
France (1938)	53
United States	41
Japan	23
British India	3.2
Russia (1938)	2.2

Before the second World War, Great Britain usually led the world in the total amount of trade. Over a normal five-year period, Great Britain's share of the world trade in merchandise varied from 11 to 15 per cent. The United States had from 10 to 15 per cent. Germany's percentage varied from 9 to 12; and that of France from 6 to 7. These four countries did about 40 per cent of the world's trading, which in 1929 was valued at about 68 billion dollars and in 1935, at about 25 billions. (You will find a list of the leading exports and imports of these and other countries under **Trade** in the FACT-INDEX.)

Foreign Trade of the United States

The United States normally exports only from 7.5 to 10 per cent of the goods it produces. The rest is consumed at home. This small percentage, however, is very important to the country's economic welfare, for certain industries depend on foreign markets to buy a much larger proportion of their output. Cotton, for example, one of the leading crops of the United States,

is a leading crude material export. Before the second World War half of the annual crop went to other lands, and more than a third of the leaf tobacco was exported. Foreign countries bought half the phosphate rock, copper, turpentine, rosin, and sardines produced in the United States, and from a fourth to a half of its sewing machines, printing machinery, office appliances, agricultural machinery, and aircraft.

About 50 per cent of the exports usually consist of:

Exports	*1929*	*1939*
Cotton, unmanufactured.	$771,000,000	$243,000,000
Machinery	612,000,000	502,000,000
Petroleum and products.	561,000,000	385,000,000
Automobiles and parts	539,000,000	254,000,000

A wide range of products is included in the other 50 per cent, for the United States exports almost everything from abrasives to zinc.

Great Britain is usually the chief customer. Normally it buys about one-fifth of all United States commodity exports—chiefly cotton, tobacco, and manufactured goods. Canada is usually the second-best world customer, but it stood in first place during and after the second World War.

Latin American countries took a larger share of United States goods when trade with Japan and Germany was cut off by the war. Europe normally takes nearly half of the exports and supplies nearly a third of the imports that enter into the international trade carried on by the United States.

The United States is self-contained to a great degree and needs fewer imports than most other countries to meet its needs. Yet some of its leading industries are dependent on imports for their raw materials; and the high standard of living of the American people leads to the importation of a number of products that might be classed as luxuries.

HOW TO READ A BALANCE OF PAYMENTS TABLE

The following table is taken from a bulletin of the United States Department of Commerce.

UNITED STATES BALANCE OF INTERNATIONAL PAYMENTS, 1935 (IN MILLIONS OF DOLLARS)

Item	*Receipts from foreigners for "exports" (credits)*	*Payments to foreigners for "imports" (debits)*	*Net credits (+) or debits (−)*
Trade and service items			
Merchandise	2,388	2,133	+255
Freight and shipping	63	99	−36
Tourist expenditures	117	409	−292
Immigrant remittances	5	92	−87
Charitable, educational, & other contributions	....	28	−28
Interest and dividends	521	146	+375
Government transactions.	28	83	−55
Miscellaneous services	116	40	+76
Total	3,238	3,030	+208
Gold, silver, & currency			
Gold exports & imports	2	1,741	−1,739
Silver exports & imports.	19	355	−336
Paper currency movements	30	31	−1
Capital items			
Reported movement of short-term banking funds	....	....	+970
Reported long-term capital movements	2,009	1,547	+462
Misc. capital items	....	....	+105
Residual item	....	....	+331

If you add all the plus items in the last column and all the minus items, you will find that the sums are equal—imports and exports balance. In international finance, the invisible items are considered as "exports" and "imports" just as if they were goods. For example, when an American sends $100 to his mother in Germany, the item is treated as though it were payment for an import of goods of that value. The movie royalties paid by foreigners to American investors are treated as exports from the United States.

There is usually a "residual item" in Department of Commerce statements because of inability to estimate exactly all the current invisible items and credit transactions or because of incorrect valuations on commodity exports and imports.

The figures for 1934 and 1935 are unusual because gold and silver imports were greater than for any other years in the country's history, as a result of the high prices paid for these metals by the United States under its "managed money" policy.

In years of normal trade, before the second World War, three leading American imports were:

Imports	*1929*	*1939*
Coffee	$427,000,000	$140,000,000
Crude rubber	241,000,000	178,000,000
Cane sugar	209,000,000	125,000,000

Other products that are imported in large quantities are paper and manufactures, wood pulp, vegetable oil, tin, chemicals, fruits and nuts, furs, burlap, and wines and spirits. Americans also demand luxuries from abroad. They buy Russian caviar, English tweeds, French perfumes, Brussels lace, Swiss watches, and African diamonds.

Visible and Invisible Items

When we speak of a country's foreign trade, we usually refer to the merchandise it exchanges with other countries. The goods exchanged by nations are called the *visible items* of international trade. And gold and silver bullion which a nation imports or exports is also a visible item.

Besides these tangible goods, nations also exchange services of various sorts, which economists call the *invisible items* of international trade. These invisible items are tremendously important in any consideration of the trade between nations, as we shall see. They include such kinds of transactions as these:

1. Payment for freight. Britain, for example, had a large share of all the ships in the world and received large sums of money for carrying goods for the people of other nations.

2. Payment for insurance. Insurance companies insure foreign firms or individuals.

3. Tourists' expenditures. Travelers from another country spend money for hotel accommodations, guides, railway fare, as well as for services.

4. Immigrants' remittances. Money is sent by immigrants to their families in their homelands.

5. Investments. Individuals, corporations, and banks invest capital in the industries of foreign countries and lend money to foreign governments.

6. Bankers' commissions. Bankers in one country perform services for the citizens or corporations of another country, for which they are paid commissions.

Let us see how these invisible items change the picture of international trade.

Balance of Trade

As you read about international trade in newspapers and magazines, you will find much discussion of the *balance of trade*. In a given year, for example, the United States may send to other countries 4½ billion dollars' worth of goods. It may receive from other countries only 4 billion dollars' worth of goods. The newspapers would then say that the United States had a "favorable" balance of trade of half a billion dollars—that is, its merchandise exports were greater in value than its merchandise imports.

Two or three centuries ago a school of economists called Mercantilists believed that a favorable balance of trade was necessary to the economic welfare of a country. They believed that if a country had an "unfavorable" balance of trade it would have to ship out its gold and silver to make up the difference and that it would soon be without money.

Many people still believe in the desirability of a so-called favorable balance of trade, but, like the economists of another generation, they fail to take account of the invisible items. A nation may export more goods than it imports and still owe money to other nations for services they have performed. Again, a nation may import more goods than it exports and still have a favorable balance when the value of its invisible items is added. For example in 1938, the last normal trade year before the second World War, Britain imported nearly 5 billion dollars' worth of goods, and exported only 4 billion dollars' worth. Thus Britain seemed to have an unfavorable trade balance of 1 billion dollars. But if you add money paid to Britain for carrying goods, for insurance and banking services, by tourists, and so on, you will find that the unfavorable balance was more than offset by these items.

In any consideration of the status of a country's international trade, the invisible items must be taken into account and the total *balance of payments* must be considered. Only in that way can a true balance of trade be shown. In the long run, of course, no country can continue indefinitely to have either a favorable or an unfavorable balance of total trade, *for imports have to be paid for by exports* (called the economic *Law of Reciprocity*). In other words, a country can buy only to the extent that it can sell, either in goods or in services, and the total volume of trade depends upon the total volume of production (called *Say's Law*). These principles were proved on a world-wide scale during and after the first World War.

Creditor and Debtor Countries

When the war broke out in 1914, the people in the United States were in debt to the people in other countries to the extent of 2½ billion dollars; so the United States was a *debtor country*. Since the early days of the Union, Americans had been borrowing from other countries to establish industries, to build railroads, and to pay for public works. But during the war other countries began to borrow from the United States to buy food and munitions; and after the war the United States was a *creditor country*, to which other countries owed 12½ billion dollars net.

The interest on this money amounted to several hundred million dollars a year. In addition, the United States exported more goods than it imported, and so other countries owed the United States several hundred million dollars a year for goods. This was only partly balanced by invisible items. To pay the enormous remainder each year, debtor nations had to increase their exports to the United States until the value of those exports exceeded the cost of imports. When the United States discouraged that plan, debtor nations could pay their debts only by borrowing more American money. This process broke down in 1929 when United States banks stopped loans to debtor nations. Europe at once cut down its imports, and a world-wide depression followed. Prices shrank. The value of world trade fell to a third, and the volume to three-quarters. In the second World War, the United States stimulated world trade by its lend-lease policy. But the return of peace in 1945 revived the problems of international loans (*see* Truman).

England for many decades had been lending money to other nations. But it had usually been willing to allow debtor countries to pay the interest on their loans by shipping goods to England. The United States faced the problem of whether or not it wants to become a larger and larger creditor nation. If it does not, it probably will have to permit other countries to ship it more goods than it ships them.

How People Pay for Foreign Goods

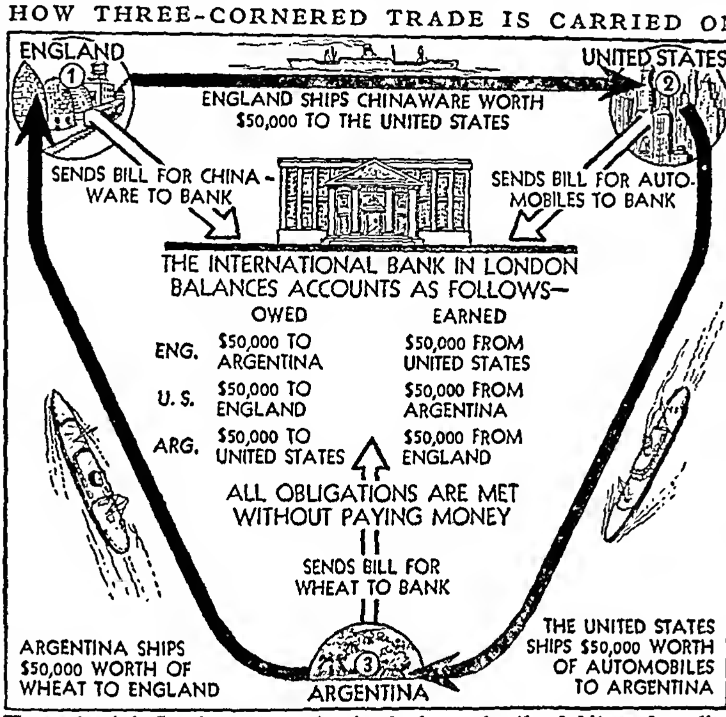
If all countries had the same money units, one of the most difficult problems of international trade would be solved. But one country's money is not good in another country, and so an elaborate machinery is necessary to handle international trade transactions. If you should order some chinaware from an English firm, you would have to pay in pounds. How would you go about paying your bill?

It is the two-way character of trade that solves this problem. Merchants in the United States are always buying goods in England, and English merchants are always buying goods in America. Suppose a man in New York wants to buy $1,000 worth of china in England and a man in London wants to buy $1,000 worth of typewriters in the United States. The business transaction would be simple if the New York buyer of china could pay his bill in dollars to the American typewriter firm and the London buyer of typewriters could pay his in pounds to the English china firm.

This, in principle, is just how international trade is carried on. But the transaction is handled not by individuals or firms but by the great international banks. An American bank sets up a branch in London or opens an account with an established English bank. Such a bank is able to pay the American exporter in American money and the English exporter in English money. It does not, however, "match up" single transactions such as those described above. It operates by the use of credits obtained through sales of goods to the country in which it is situated.

A New York exporter, for example, makes out a bill of exchange for goods which he has sold to a merchant in London. He sells this bill to his New York bank and receives his money. The New York bank sends the bill of exchange to its London branch, which asks the London merchant for payment. The latter pays the amount of the bill to the bank in pounds. The bank, instead of sending the money to the New York bank, keeps it and uses it to pay a London manufacturer who presents a bill of exchange for goods sold to a New York customer. The bill of exchange is only one of a number of credit instruments used in international trade (*see* Credit).

HOW THREE-CORNERED TRADE IS CARRIED ON



Here a bank in London acts as the clearinghouse for the debits and credits arising from international trade. Often the transactions of three or four or even more countries are involved in making accounts balance.

The transaction, of course, is not usually so simple as this, for much of international trade is three-cornered or even four-cornered. Suppose Argentina buys American automobiles. The United States does not buy Argentine beef or wheat, but England does. So England pays Argentina for its wheat and beef at a London bank; Argentina then uses this credit to pay the United States. But the United States, which has been buying English goods, uses this same credit to pay its English customers. Thus all three countries settle their debts without actual transfer of money.

When trade between two countries becomes too one-sided, the large buyer may not be able to get enough of the small buyer's money (or bills of exchange) to pay for its imports. This is what causes rates of exchange to rise and fall (*see* Foreign Exchange).

Governments and International Trade

Most of the world's trading is done by private business interests, rather than by governments. Governments, however, have always regulated the foreign trade of their nations to a greater or less degree by legislation and treaties; and a government's foreign trade policy always has an important place in its economic program. In the United States it is one of the vital questions on which presidential campaigns are fought (*see* Political Parties). In Russia foreign trade became a government monopoly. That has been the tendency in nations with authoritarian government, as in Germany when under Nazi rule.

Almost all governments have set up *tariffs*, that is, taxes on goods imported from foreign countries (*see* Tariff). Through commercial treaties, governments make special agreements with other governments regarding the importation of certain goods. They also make "most favored nation" agreements with other nations. By such an agreement two nations guarantee that all the trade favors that are granted by either of them to a third nation shall immediately be granted to the other contracting nation. Thus, to all the nations on its "most favored" list the United States extended the benefits of tariff reductions negotiated with any one country under the Reciprocal Trade Agreements Act of 1934.

Protecting Health and Increasing Trade

Among the routine functions of governments in international trade is the regulation of imports to protect the nation's health and its plant and animal life. The quarantines and embargoes that are placed by the United States on certain agricultural products are examples of this type of regulation. Such a *quarantine* holds up the entrance of a plant, animal, or other product suspected of being a carrier of a pest or disease until it can be inspected. An *embargo* prohibits a product from being brought into the country.

Most governments also have special departments that assist in developing their foreign trade. In normal times they maintain consuls in the leading commercial centers of the world. The consuls seek out new opportunities for their merchants and financiers at home, and also assist citizens who are carrying on business abroad (*see* Diplomatic Service). Besides its consular service, the United States has a bureau of Foreign and Domestic Commerce and an Office of International Trade Policy (*see* United States Government).

Chambers of commerce in the United States and other countries coöperate with government agencies in the task of expanding foreign trade.

Growth of International Trade

During the 19th century international trade grew rapidly, largely as a result of the Industrial Revolution (*see* Industrial Revolution). Many countries developed into vast workshops and began to exchange their factory products for agricultural products and raw materials. Since mass production makes products cheaper, manufacturing industries expanded, specialization increased, and there was a growing demand for foreign markets for surplus output. As populations grew, large numbers emigrated to new countries; and the demand of the young countries for goods they could not produce stimulated international trade.

Banks and individuals invested immense amounts of capital in foreign countries—especially in the younger countries, such as the United States, which were thus enabled to expand their industries and establish new ones. Railroads linked seaports with the interior. With the coming of the steamship, ocean freight rates were reduced, so that even bulky goods of low value could profitably be shipped to distant manufacturing centers. The world was becoming more and more interdependent, and the value of world trade was doubling about every 20 years. It was nearly 3 billion dollars in 1840; 7 billions in 1860; 14 billions in 1880; 20 billions in 1900; 40 billions in 1913.

From First World War to Depression

The first World War brought far-reaching realignments of trade among nations. Warring nations strained their resources to meet their needs and borrowed heavily to buy supplies from neutral countries, which increased their production many fold to meet the unusual demand. After the war, they continued to borrow credit and to import goods at increasing prices. Failing, from several causes, to expand manufactures, the value of Europe's exports in the period 1921–25 merely equaled that of the year 1913, while the United States and other countries showed a substantial increase. The day of reckoning came, as we have seen. Some nations could no longer borrow and buy, other nations lost their markets, and the result was the world depression of the 1930's.

With the collapse of normal trade, nations set up trade controls intended to increase their exports and reduce their imports. Each sought thus to bolster its own faltering economy. But the obvious drawback in this was that one nation could not profit without others losing, and so all were ultimately bound to suffer from burdensome restrictions. France led the way in placing quota restrictions on imports to build up its own industries. A *quota* limits the quantity of certain products that may be imported from a particular country in a specified period. Many of the leading nations also devaluated their currency in an effort to give their products a more favorable position in world markets (*see* Money). Campaigns were launched, for example, to "Buy American" or "Buy British," with the object of stimulating domestic production and curtailing imports.

Economic Nationalism between World Wars

These devices were offshoots of the policy of *economic nationalism.* Under this policy a nation seeks to make itself as nearly self-sustaining as possible. It imposes tariffs, quotas, and similar restrictions on imports, and renders government aid to domestic industry and agriculture. Such measures were adopted by many countries during the depression.

Economic nationalism took a new form in the foreign trade policies of the National Socialist (Nazi) régime in Germany after 1933. Germany sought to free itself from dependence upon countries whose goods might be cut off by a military blockade. *Autarchy,* or complete economic self-sufficiency, was its aim.

The Nazis used quotas, tariffs, and government subsidies to export industries, to eliminate "nonessential" imports, and to build up credits abroad. Where no credits existed, Germany negotiated *barter agreements.* Germany bought copper from Chile, let us say, and paid for it in "Aski marks." This was not actual currency. It was a credit, placed in German banks in a "blocked" account. No one but Chilean importers could use the credit, and they could buy only specified commodities. Since no money was exchanged, such deals were often called *clearing agreements.*

The barter system enabled Germany to obtain needed supplies. Deals were made chiefly with the nations of southeastern Europe and Latin America. The Nazis also reduced the value of Aski marks, compared with foreign currencies. Thereby the foreign customer obtained more purchasing power in Germany. This cost Germany more in goods, but it enabled the Nazis to draw other nations into deals and get the raw materials they needed for war. (*See also* Germany.)

Preference Tariffs and Sterling Bloc

Britain had long been a free-trade nation, but in the depression of the 1930's it began to impose protective tariffs. It soon exempted countries within the British Empire and got tariff concessions from them. This policy tended to increase trade within the empire and was called *empire preference.* Later it was called simply *preferential tariffs.*

In the 1930's various nations began abandoning the gold standard (*see* Money). Britain then persuaded a bloc of nations to fix the value of their currencies for foreign trade in terms of the pound sterling. The countries in this *sterling bloc* kept a good part of their central bank reserves in sterling. When the second World War began, England needed vast sums in dollars to buy munitions in the United States. The sterling area nations pooled their dollar resources and limited their dollar purchases so Britain could buy arms. After the war the United States lent Britain $3,750,000,000 in dollar credit to be spent in the United States. In return, Britain promised to abolish the sterling area dollar pool and to relax preferential tariffs. But in the international tariff pacts of 1951 Britain retained preferentials.

During the depression years, the United States saw that its prosperity was linked to the 10 per cent of its income that came from world trade. In 1934 Congress established the Export-Import Bank and passed the Reciprocal Trade Agreement Act to strengthen this trade. The Bank makes loans to foreign countries to help develop their resources and to supply credits for trade with the United States. The Act permitted the negotiation of two-way treaties calling for reduction of tariffs up to 50 per cent by each nation. When the Act was renewed in 1945, it allowed another 50 per cent reduction.

During the second World War, munitions and other war goods made up nearly all world trade. After March 1941, most of the material the United States shipped to its Allies was paid for under the Lend-Lease Act (*see* Roosevelt, Franklin D.).

United Nations World Trade Agencies

Even before the war ended the United Nations began establishing agencies to stimulate world trade. Representatives of 44 countries planned the International Bank for Reconstruction and Development and the International Monetary Fund, at Bretton Woods, N. H., in 1944. They began operating in 1946.

The Fund's purpose was to aid world trade by stabilizing national currencies. It was a money pool which could furnish a nation with any national currency it needed to pay for imports in return for an equal amount of its own currency. Later, the borrowing country repaid in the borrowed currency or in gold. The Fund's capital was set at 8.8 billion dollars.

The Bank lent money for the rehabilitation of war-torn countries and for the development of resources in any land. It guaranteed loans from private investors after getting assurance from the borrower's government. Its capital exceeded 8 billion dollars. Capital for both the Fund and the Bank was subscribed by the member nations on the basis of their financial strength. Each country voted in proportion to its subscription. The United States held the controlling vote.

The International Trade Organization (ITO) aimed to eliminate world-trade barriers and to supply machinery for settling trade disputes. A preparatory committee, meeting in Geneva, Switzerland, in 1947, negotiated a trade and tariff agreement, which reduced national tariffs on thousands of products. The agreement provided that all negotiating countries should benefit from any concessions made by one country to another. The ITO charter was drafted at Havana, Cuba, in 1947–48. Ratification by member nations was required to make the charter binding. But by 1951 the United States had not ratified the pact.

Effect of ERP on World Trade

An enormous volume of world trade resulted from the European Recovery Program (ERP) of the United States. War-torn European nations needed goods of all kinds for industrial and economic rehabilitation, but they lacked dollars. On April 2, 1948, Congress passed the Foreign Assistance Act providing for the issuance of credits amounting to more than 5 billion dollars in the first year (During its four years of operation the program expended about 12 billion dollars.) The Act created the Economic Co-operation Administration to administer the program.

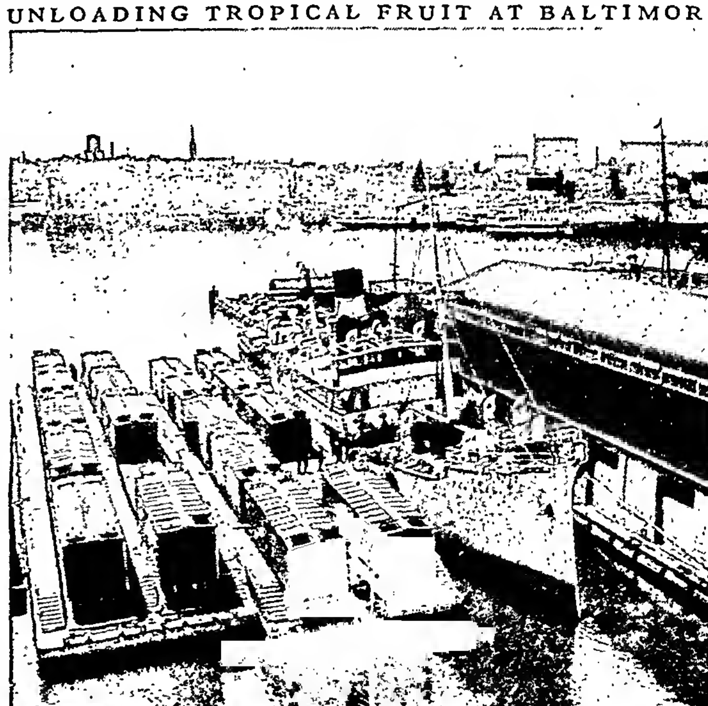
The ECA determined the amount of economic aid that was to be given each participating country and the proportion to be offered in long-term loans and in grants-in-aid. In return for this aid, the contracting countries agreed to promote expansion of their production and trade, to coöperate and trade with other countries, and to take steps to maintain currency stability and sound rates of exchange. They also agreed to supply the United States with the scarce materials it needed for stockpiling.

Trading under the ECA

Customary channels of trade were used. For example, if a French manufacturer wanted machinery, he first got his need for it certified by a French agency and by the ECA. Then he ordered the machines from any American firm he chose. The ECA issued a letter of commitment agreeing to pay the supplier in dollars from the funds provided by the government.

When the goods were delivered, the French buyer paid for them in his country's currency. This payment went into a *counterpart fund* controlled by the ECA. The ECA paid its administrative expenses in France, and used the rest to stabilize finances or stimulate production in France. Governments bought goods and paid to a counterpart fund in much the same way.

UNLOADING TROPICAL FRUIT AT BALTIMORE

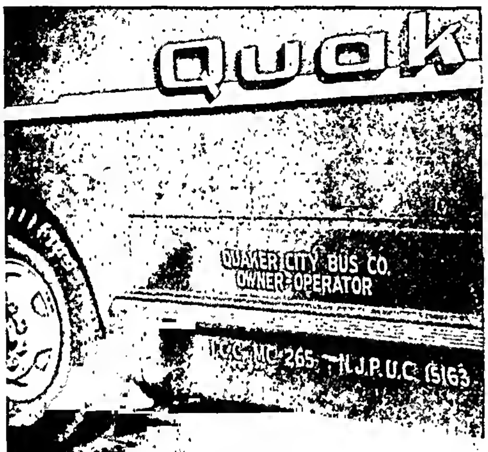


Here perishable bananas from Central America are being transferred from a freighter to refrigerator cars on railway lighters. Americans must get bananas through international trade, because the fruit will not grow at home.

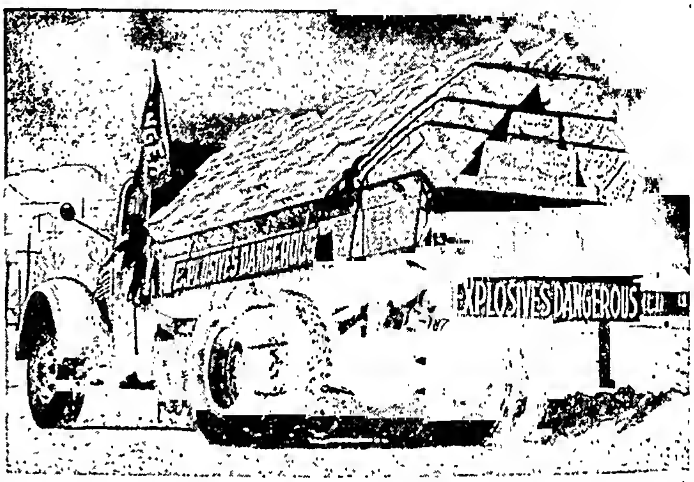
INTERSTATE COMMERCE COMMISSION. After the Civil War, the rapid development of railroads in the United States led to sharp competition for business. Many communities were served by more than one railroad and by water routes as well. In order to win business away from their competitors, transportation companies often engaged in "rate wars"—that is, each company sought to keep its rates just a little lower than those of its competitors.

Sometimes the rates were forced so low that the companies faced financial ruin and the public interest was threatened. Railroads also competed for business by secretly giving lower rates and better services to favored persons and companies. Regulation by states failed to prevent this discrimination. Public opinion demanded action by the federal government. Accordingly, Congress in 1887 passed an act creating an Interstate Commerce Commission to regulate commerce among the states.

TWO FORMS OF INTERSTATE MOVEMENT UNDER I. C. C. CONTROL



The "I.C.C. MC-265" stenciled on the side of the bus indicates that authority for carrying passengers has been granted.



Interstate Commerce Commission regulations for the movement of explosives have been obeyed by the owners of this truck.

Regulates Other Common Carriers

The powers granted under this act, as interpreted by the courts, were found to be insufficient. Therefore in later years Congress passed a series of measures to strengthen the Commission and to extend its authority to other common carriers. These included the Elkins Act (1903), the Hepburn Act (1906), the Mann-Elkins amendments (1910), the Valuation Act (1913), and the Transportation Act of 1920 (Esch-Cummins Act).

Eleven members, appointed by the president for terms of seven years, make up the Commission. It has a large administrative staff. It is charged with seeing that railroad rates and services are fair and reasonable and that rates are published. It oversees the distribution of cars, and inspects safety devices and locomotives. It collects and publishes financial statistics on the carriers.

Before 1920 the principal objective was the correction of abuses. The Transportation Act of that year gave the Commission the duty of developing, coordinating, and maintaining a national transportation service. Under this act, the rule in rate making is to give well-managed carriers a chance to earn a fair return upon their capital. The Commission must give its permission before a carrier can issue securities or construct or abandon lines. It passes on mergers and consolidations of carriers. It has duties under the railroad bankruptcy laws, such as approving plans of reorganization and ratifying the selection of trustees.

Most of the Commission's activities result from complaints by shippers, by city or regional business associations, or by the railroads themselves. After due hearing, the Commission issues its order. This must be obeyed promptly. Later, appeal can be taken to the federal courts and the order may be set aside. The Commission acts on its own initiative in certain matters, such as devising a plan for combining railroads into larger systems. It also carries out investigations ordered by Congress. It is required to publish its decisions and to make an annual report to Congress.

The Commission controls other interstate common carriers, such as express companies and oil pipe lines, and, by the Motor Carrier Act of 1935, highway truck and bus lines. Under the Transportation Act of 1940 it regulates ship traffic operating on coastwise, intercoastal, and inland waters. In 1942 the Commission was given jurisdiction over freight-forwarding companies. It has no authority over airplane transportation. The Civil Aeronautics Board (1938) regulates air commerce (*see* Aviation). The Commission had authority over telephone, telegraph, and cable services until the Federal Communications Commission was created in 1934.

The Commission's powers are based on the clause in the Federal Constitution which gives Congress power to "regulate commerce among the several states." While the Commission deals mostly with interstate commerce, its power extends to commerce within a state when necessary to protect interstate interests.

INVENTIONS—*New Products and Processes for a Better World*

INVENTIONS. The world's progress is due largely to inventions. Whenever a new method, machine, or "gadget" is invented, it helps man to live a little easier or better or longer. Bit by bit, inventors add to man's wealth, knowledge, and comfort.

Inventors work with known things and known principles. They combine these in a different way to make a new product or process. A discovery differs from an invention. A discovery is something found in nature that was unknown to man before. A new chemical element is a discovery; a new type of engine is an invention.

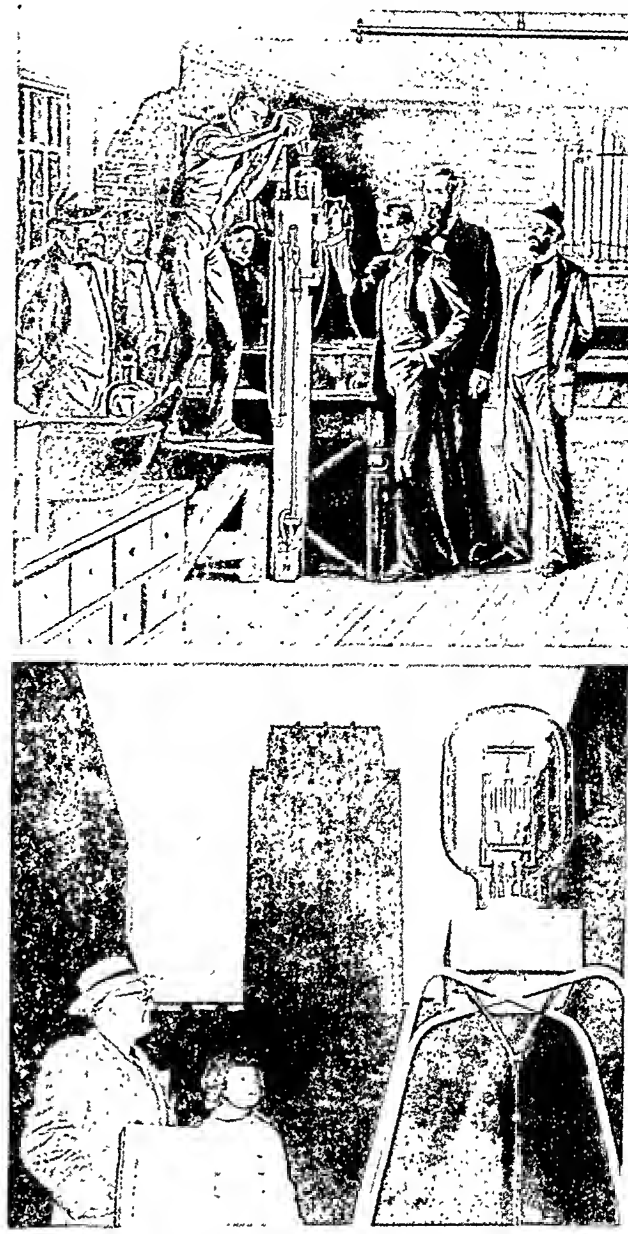
Today inventions are being made in all fields—mechanical, chemical, electronic, and nucleonic, among others. New machines, new drugs, new ways of communication, and new uses of atomic power appear often. New inventions make new jobs, businesses, and industries. They bring wealth to a nation and help prepare the way for still more inventions.

Outstanding American Patents

In 1940 the Patent Office celebrated the 150th anniversary of the founding of the American patent system. Noted scientists, industrialists, and statesmen were asked to nominate the greatest American inventions patented by the United States Patent Office. Here is their selection:

INVENTION	INVENTOR	DATE PATENTED*
Cotton gin	Eli Whitney	March 14, 1794
Commercial steamboat	Robert Fulton	Feb. 11, 1809
Reaper	Cyrus McCormick	May 21, 1834
Telegraph	S. F. B. Morse	May 20, 1840
Rubber vulcanization	Charles Goodyear	May 15, 1844
Sewing machine	Elias Howe	Sept. 10, 1846
Typewriter	C. L. Sholes	June 23, 1868
Air brake	G. Westinghouse	April 13, 1869
Telephone	A. G. Bell	March 7, 1876
Phonograph	T. A. Edison	Jan. 27, 1880
Induction motor	Nikola Tesla	May 1, 1880
Aluminum reduction	C. M. Hall	April 2, 1889
Linotype	O. Mergenthaler	Sept. 6, 1890
Movie projector	T. A. Edison	March 14, 1893
Airplane	Wright brothers	May 22, 1906
Audion	Lee De Forest	Jan. 15, 1907
Bakelite	Leo Baekeland	Dec. 7, 1909
Oil cracking	W. M. Burton	Jan. 7, 1913

*These dates often differ from the dates of first known use given in the table at the end of this article.



Edison (top) tested the first electric light bulb at Menlo Park, N. J., in 1879. The 750,000-watt lamp (bottom) was used in the celebration of the 75th anniversary of this event, in 1954.

These inventors have widely different backgrounds. Most were native Americans; a few, such as Tesla, were foreign born. Some, such as De Forest, were college-trained scientists. Some, such as Edison, were self-educated. Some, such as Howe, began learning as they began inventing. Some, such as Westinghouse, were professional inventors.

Three Early Inventors

Eli Whitney's cotton gin was the first great invention to come out of the new United States. It mechanically separated the seeds from the raw cotton bolls, a job that formerly had to be done by hand. Whitney also perfected the method of making standardized, interchangeable parts in musket manufacture. Interchangeable parts make modern assembly line production possible (*see* Industry, American; Whitney).

PIONEER AMERICAN INVENTORS

Benjamin Franklin (left), first great colonial American inventor, wore his bifocal lenses in spectacles, which he invented in 1760.

Cyrus H. McCormick (right) publicly tested his reaper in 1831, walking behind it as a worker rakes cut grain from the platform.

Robert Fulton did not invent the first steamboat. His ship, however, was the first to give regular service, making steam navigation an accomplished fact (*see* Fulton). Cyrus McCormick's reaper was perhaps the most important invention in agriculture since the prehistoric plow. It cut grain far faster than men could reap with cradle scythes. It also paved the way for more complex machines, notably the modern combine (*see* Agriculture; McCormick).

Three Single-minded Men

Samuel F. B. Morse was a successful portrait painter with a keen, though amateur, interest in science. The idea of a telegraph came to him when he was 41. He labored 12 years to complete his electric telegraph system (*see* Morse; Telegraph). The search for a process to make rubber usable resulted in Charles Goodyear's vulcanization method. Goodyear tried everything imaginable—witch hazel, cream cheese, black ink—but nothing worked. Finally he stumbled on a sulfur-heat combination that prevented rubber from becoming brittle with cold or sticky with heat (*see* Rubber).

Elias Howe was a young machine shop assistant when he got the idea of a sewing machine. For years he battled poverty, men who would do him out of royalties, patent infringers, and backsliding backers, but he finally won out. He was at last rich and in full control of his patents (*see* Howe; Sewing Machine).

Three Starters of Trends

The invention that made the modern business office possible was the typewriter. The first practical machine was invented by Christopher L. Sholes, a Wisconsin printer, and two associates. Sholes's device had two new features: the carriage itself moved one space to the left when a key was struck; and the keys worked on a "pianoforte" action (*see* Typewriter).

George Westinghouse patented the railway air brake when he was only 23 years old. He made his invention foolproof by reversing the normal method of using compressed air. The brakes, when *not* in use, were kept off the wheels by compressed air pressure. To stop the train the engineer decreased the air pressure, and the brake shoes fell against the wheels (*see* Brakes; Westinghouse).

The inventor of the telephone, Alexander Graham Bell, was a young teacher of speech to the deaf. He had a scientific interest in sound and electricity. This led to his invention and the most valuable patent ever issued. By 1900 there were more than 3,000 other patents issued for telephone improvements (*see* Bell, Alexander Graham; Telephone).

Three Electrical Men

During his long career, Thomas A. Edison actually patented 1,093 inventions. His electric light, dynamo, and movie projector were original variations of already known devices. In no way does this detract from his inventive genius. Like most other inventors he worked with principles and devices worked out by earlier men. His phonograph, however, was a brand-new idea (*see* Edison; Motion Pictures; Phonograph).

Tesla, inventor of the alternating current induction motor, also developed transmission of power by wireless. He harnessed the water power of the Niagara,

FIRST TELEGRAM
In the United States Supreme Court chamber in 1844, S. F. B. Morse sent his first dispatch: "What hath God wrought?"

and the principle of his oscillation transformer is used in radio transmitters and receivers (*see* Electricity).

The process of reducing alumina to aluminum by electrolysis was invented by Charles M. Hall. Hall was only 22 when he made his remarkable invention. Without any contact with Hall, a young Frenchman, Paul Héroult, invented the same process in the same year. Héroult's patent was adopted in Europe, Hall's in America (*see* Aluminum; Hall, Charles M.).

Three Endless Experimenters

The greatest invention in printing after movable type was the linotype, devised by Ottmar Mergenthaler. This typesetting machine, which casts a line of type in one piece, differs in one unique way from those that came before. It is *self-justifying;* that is, before the line is cast, the line is filled out to the right-hand margin by spaces inserted between words and letters (*see* Linotype).

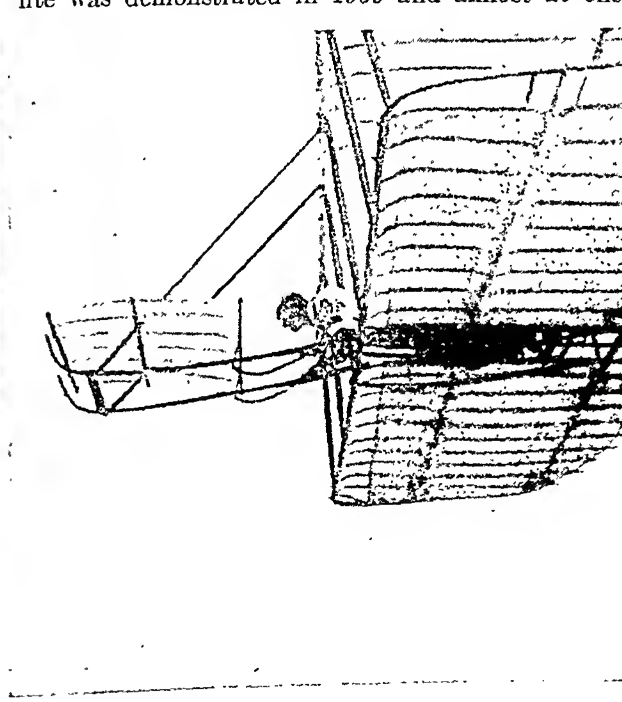
The Wright brothers built and flew the first successful heavier-than-air, controlled, powered machine. Since early times many men had tried to fly. Some, especially the glider men Chanute and Lilienthal, had actually risen off the ground. None before the Wrights had met the requirements of power, control, and a man-piloted craft. Their invention ushered in a new Air Age which is still advancing (*see* Airplane; Wright Brothers).

Lee De Forest turned the wireless telegraph into the speaking (and singing) radio of today. His main contribution was the three-electrode vacuum tube, also called the *triode,* or *audion.* In 1904 J. A. Fleming had invented a tube with two electrodes—filament and plate. De Forest set a grid between the two and started radio on its way (*see* De Forest; Radio).

Two Scientist-Inventors

Leo Baekeland, Belgian born and educated, invented Bakelite, the first of a long series of thermosetting plastic resins. He spent years in methodical research, protecting his final product with 400 patents. Bakelite was demonstrated in 1909 and almost at once

INVENTIONS THAT CHANGED THE WORLD
Using a woodburning stove in his home, Charles Goodyear stumbled on the vulcanization process that made rubber usable.



In 1901 Wilbur Wright tested this glider, forerunner of the powered airplane of 1903 that marked the start of the Air Age.

IMPORTANT EARLY INVENTORS

Left, Galen (A.D. 130?–200?), Greek physician, devised many new drugs and medicines. Here he shows an ointment to a patroness. Right, in the 1440's came Gutenberg's process of printing from movable type. Here he shows a Bible page to his associates.

adopted in many fields, notably in automobile and in radio parts manufacture (*see* Plastics).

In 1913 W. M. Burton patented his thermal cracking process. It was the first successful method of breaking down the larger molecules of crude oil into lighter, smaller gasoline molecules. Burton's invention helped the oil industry keep pace with the rising demand for more gasoline (*see* Petroleum).

Beginnings of Invention

Invention began with man himself. Long centuries before the invention of writing, man had worked out many important tools. Among these were fire-making devices, the wheel and axle, the pulley, the saw, the screw, the wedge, and the inclined plane. From these a great series of inventions have followed. The wheel, for instance, is the basis for all wheeled things, from roller skates to racing cars. It is used also as a water wheel, potter's wheel, as a steering or controlling device, and as part of engines—the flywheel, for example.

In those days long past some people lived in villages and worked on farms. They baked clay into pottery and plaited rushes into baskets. They spun hair, wool, and flax into thread and wove the thread into cloth. They made stone axes for hewing timber. After a long time they learned to smelt metals for tools. In time they invented weights and measures and a way of telling time and date.

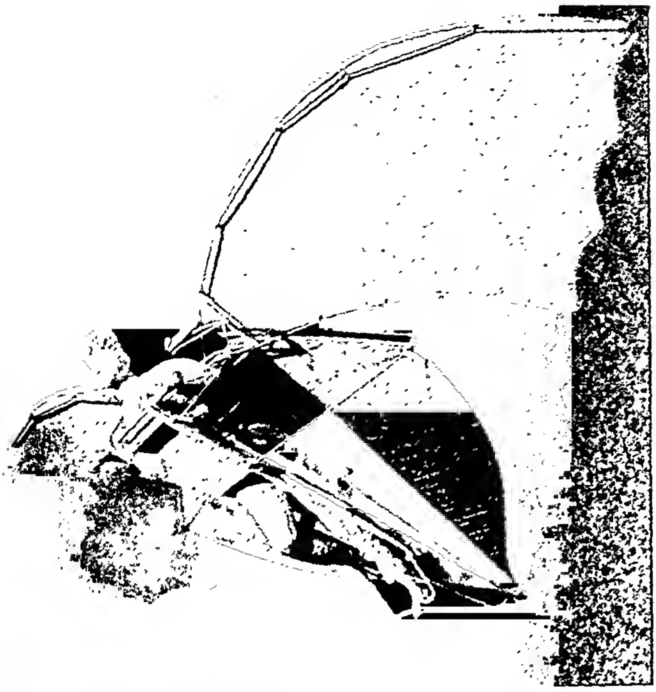
Early men dug wells and irrigation canals. They had drains, sewers, and a water supply to their homes. Gradually they learned to glaze pottery, use fluxes for working gold and other metals, and make opaque glass for beads. They had lamps for lighting and water clocks for telling time. Among other prehistoric inventions were animal-powered gristmills and devices to lift water for irrigation.

Until almost modern times invention went ahead in a hit-or-miss way. There was no science behind it. Instead there were half-truths, superstitions, and false notions based on the magic and mystery of the times. These false ideas sent men on fruitless searches for impossible goals. It kept them from the steady quest of science and the inventions that might have resulted. Men progressed only when the need was great and the solution easy or near at hand. Inventions were highly practical and close to home.

Inventions continued to be made in increasing numbers through the times of the Greeks and Romans. They continued even during the Middle Ages, when progress was thought to have halted. During the Renaissance, first Italy, then France, and finally England were caught up in a wave of renewed interest in art, science, and invention (*see* Renaissance). The man who best showed skills in all these activities was the Italian genius Leonardo da Vinci (*see* Vinci).

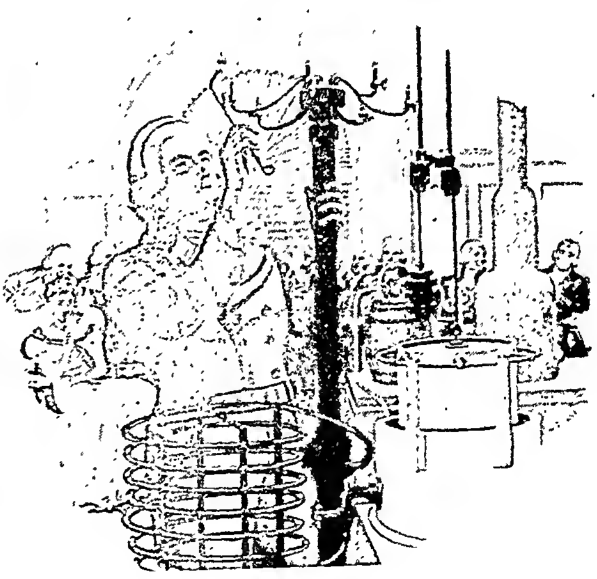
The next great era of inventive activity started in England in the 1700's. This was the period called the Industrial Revolution. A number of brilliant inventions helped start the modern industrial system (*see* Industrial Revolution).

One group of inventions converted cotton spinning and weaving from a handcraft to a mechanized industry. The changes began with John Kay's flying shuttle (1733). This device made it possible for one man to handle a wide loom. Next came James Hargreaves' spinning jenny (1764), which worked as many as a hundred spindles from a single wheel (*see* Hargreaves). Another device, Richard Arkwright's spinning frame



RENAISSANCE GENIUSES

Leonardo da Vinci's flying machine (left), though unworkable, had many practical features. Leonardo was a pioneer inventor of aircraft. From the tower of St. Mark's in Venice (right), Galileo demonstrated his first telescope before friends.



ENGLISH INVENTORS OF THE INDUSTRIAL REVOLUTION

In his laboratory James Watt studied an improvement on his steam pump. Later he worked out steam engines to turn wheels.

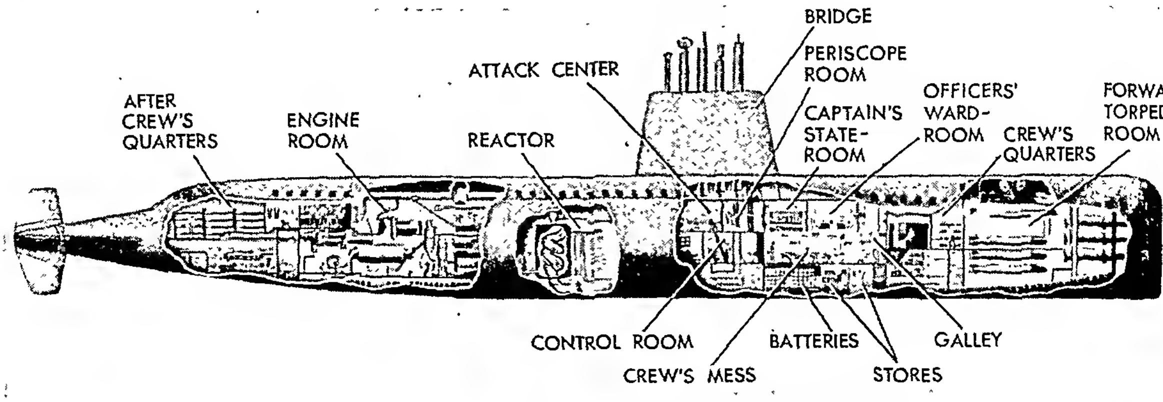
William Murdock demonstrated his illuminating gas (coal gas) fixture before a group of spectators who helped finance him.

(1769), worked by water power (*see* Arkwright). Samuel Crompton's spinning mule (1779) helped complete the industrialization of the one-time handcraft of spinning (*see* Crompton). Edmund Cartwright's power loom (1785) did the same for weaving (*see* Cartwright; Spinning and Weaving; Textiles).

Inventions Today

In former years inventors worked alone, often secretly. They used their own money and told no one of their work until it was protected by patent. Their background and training were largely practical. Their solitary habits earned them a reputation, sometimes justified, of being eccentric.

The individual inventive effort of past years is now largely taken over by organized research. Large corporations employ their own scientists and spend as much as 5 or 6 per cent of their income on research. Many of them carry on general, or *fundamental*, research. They try to find new scientific facts rather than work on problems that will yield immediate money-making devices. Yet this fundamental research often leads to popular and salable products. From such investigation conducted by one large com-



'NAUTILUS' SUBMARINE
This cutaway view of the *U. S. S. Nautilus* shows how atomic power was first put to use for transportation. It forecasts the many nonexplosive uses of atomic power for war and peace.

pany have come nylon, cellophane, orlon, and dacron.

Universities and government agencies do a great amount of fundamental research. For example, the University of Wisconsin holds an important patent on a method of increasing the vitamin D content of foods. Patent royalties help support university laboratories. Many industries also give money to universities for research purposes. Commercial laboratories do research for other companies on a fee basis.

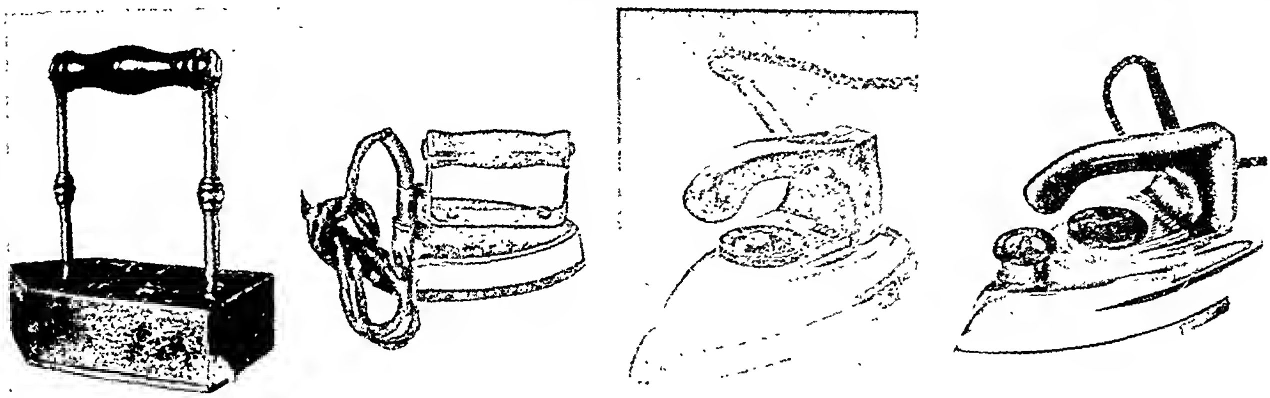
Inventive Processes

Invention is a continuing and a cumulative process. The way for a new invention is prepared by all the previous related inventions and discoveries. James Watt could devise a steam engine only because there was a long series of inventions before it. Some of these were Chinese paper, Arabic mathematics, the crank, gear, wheel, lathe, thermometer, strong cast iron, a knowledge of heat, evaporation and condensation, and a method of measuring heat energy in steam.

Invention today is tied to industrial methods and production. An invention does not come into common use, and thereby encourage further invention, until it has been mass-produced and fitted with standardized, interchangeable parts. Only by being made in large quantities and by being widely distributed is it actually tested through use. These wide uses produce further improvements and changes which may be new inventions in themselves.

Nowadays inventions continue to be made in large numbers. The United States Patent Office issues from 40,000 to 50,000 patents yearly (*see* Patent). The majority of usable and practical patents come from the work of research teams. Many useful inventions go unpatented. Among these is the Salk antipolio vaccine, released in 1955 for general use. The long line of inventions that started in the prehistoric past continues on into the present and future with no sign of letting up.

FUNDAMENTAL RESEARCH
These men (left) are studying "invisible" gases with a Schlieren camera to learn new facts about heat and gases for jet engine design. This solar battery (right), made of silicon strips, is the first device to convert the sun's energy directly into electricity.

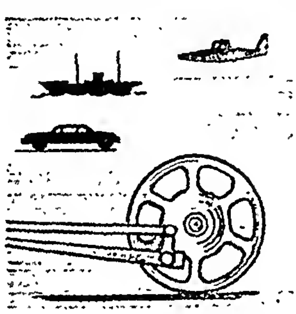


EVOLUTION OF A COMMON HOUSEHOLD ITEM—THE IRON

These four pictures show the constant change that takes place as any item is improved and modified with use. Here are four irons: a fire-heated iron of 1800, an early electric iron, a modern electric dry iron, and a modern electric dry and steam iron. Future irons will show equally big changes as inventions continue to improve efficiency and functional beauty.

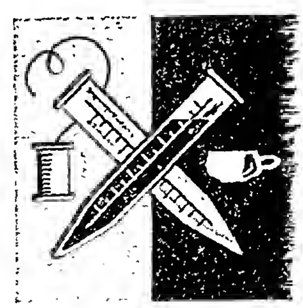
Famous Inventions and Inventors

Transportation, Steam, and Water Power



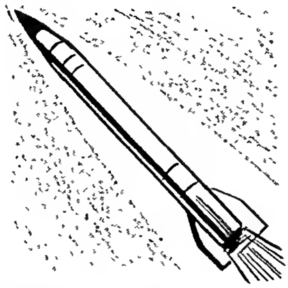
Date	Invention	Inventor	Nationality
1690	Steam engine with piston	Denis Papin	French
1698	Steam pump	Thomas Savery	English
1705	Steam engine	Thomas Newcomen	English
1707	Steamboat	Denis Papin	French
1717	Diving bell	Edmund Halley	English
1765	Steam engine	James Watt	Scottish
1769	Motorized carriage	Nicolas Cugnot	French
1783	Balloon	Montgolfier brothers	French
1785	Parachute	J. P. Blanchard	French
1787	Steamboat	John Fitch	American
1804	Screw propeller	John Stevens	American
1804	Steam locomotive	Richard Trevithick	English
1807	Steamboat	Robert Fulton	American
1814	Railway locomotive	George Stephenson	English
1827	Hydraulic turbine	Benoit Fourneyron	French
1839	Bicycle	K. MacMillan	Scottish
1847	Regenerative steam engine	William Siemens	British
1849	Hydraulic turbine	James B. Francis	American
1852	Elevator	Elisha G. Otis	American
1857	Sleeping car	George M. Pullman	American
1860	Gas engine	Étienne Lenoir	French
1865	Streamlined train	Samuel Calthrop	American
1868	Railway air brakes	G. Westinghouse	American
1873	Car coupler	Eli H. Janney	American
1875	Internal combustion engine	Siegfried Marcus	Austrian
1876	Gas engine	Nikolaus A. Otto	German
1877	Glider	Otto Lilienthal	German
1884	Steam turbine	C. A. Parsons	English
1885	Automobile	Karl Benz	German
1887	Automobile	Gottlieb Daimler	German
1887	Air-inflated rubber tire	J. B. Dunlop	Scottish
1889	Steam turbine	C. G. de Laval	Swedish
1892	Diesel engine	Rudolph Diesel	German
1896	Self-powered model airplane	S. P. Langley	American
1897	Stanley Steamer	Stanley brothers	American
1903	Airplane	Wright brothers	American
1909	Helicopter	Igor Sikorsky	American
1911	Gyrocompass	Elmer A. Sperry	American
1911	Automobile self-starter	C. F. Kettering	American
1922	Ethyl gasoline	T. Midgley, Jr.	American
1937	Jet propulsion	Frank Whittle	English

Synthetics



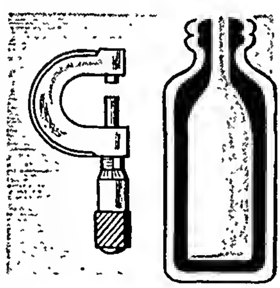
Date	Invention	Inventor	Nationality
1869	Celluloid	J. W. Hyatt	American
1880	Synthetic indigo	Adolf von Baeyer	German
1884	Rayon	H. de Chardonnet	French
1909	Bakelite	Leo Baekeland	Amcrican
1913	Synthetic ammonia	Fritz Haber	German
1930	Neoprene	J. A. Nieuwland W. H. Carothers	American American
1937	Nylon	W. H. Carothers	American

Warfare



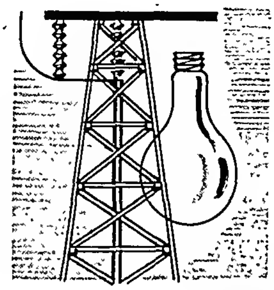
Date	Invention	Inventor	Nationality
1775	Submarine	David Bushnell	American
1784	Shrapnel shell	Henry Shrapnel	English
1810	Breech-loading rifle	John H. Hall	American
1835	Revolver	Samuel Colt	American
1845	Guncotton	Christian Schönbein	German
1852	Breech-loading cannon	W. G. Armstrong	English
1861	Ironclad steam-boat (*Monitor*)	John Ericsson	American
1861	Gatling gun	R. J. Gatling	American
1862	Blasting cap	Alfred Nobel	Swedish
1864	Self-propelled torpedo	Robert Whitehead	English
1881	Submarine	John P. Holland	American
1884	Maxim gun	Hiram S. Maxim	British
1911	Lewis gun	Isaac Lewis	American
1914	Tank	E. D. Swinton	English
1926	Liquid-fuel rocket	R. H. Goddard	American
1934	Garand rifle	John C. Garand	American

Metals and Glass



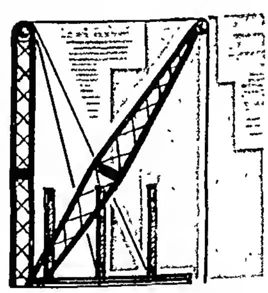
Date	Invention	Inventor	Nationality
1636	Micrometer	W. Gascoigne	English
1740	Crucible steel process	Benjamin Huntsman	English
1743	Plated silver	T. Boulsover	English
1783	Steel rolling mill	Henry Cort	English
1791	Nail-cutting machine	Jacob Perkins	American
1805	Electroplating	Luigi Brugnatelli	Italian
1815	Miner's safety lamp	Humphry Davy	English
1816	Tack-making machine	T. Blanchard	American
1838	Babbitt metal	Isaac Babbitt	American
1850	Steel converter	William Kelly	American
1856	Steel converter	Henry Bessemer	English
1858	Open-hearth steel process	William Siemens	British
1861	Electric furnace	William Siemens	British
1874	Barbed wire	J. F. Glidden	American
1883	Manganese steel	Robert Hadfield	English
1884	Milk bottle	H. D. Thatcher	American
1886	Aluminum reduction	Charles M. Hall	American
1886	Aluminum reduction	Paul Héroult	French
1895	Thermite	Hans Goldschmidt	German
1904	Bottle-making machinery	Michael J. Owens	American

Electricity and Electronics



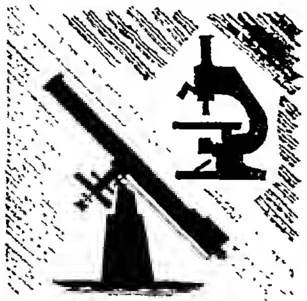
Date	Invention	Inventor	Nationality
1800	Voltaic cell	Alessandro Volta	Italian
1831	Dynamo	Michael Faraday	English
1834	Electrolysis	Michael Faraday	English
1860	Incandescent lamp	Joseph Swan	English
1868	Dry cell	Georges Leclanché	French
1878	Arc lamp	C. F. Brush	American
1879	Incandescent lamp	T. A. Edison	American
1879	Cathode ray tube	William Crookes	English
1885	Transformer	William Stanley	American
1910	Neon light	Georges Claude	French
1911	Electric light—wire tungsten filament	W. D. Coolidge	American
1913	Electric light—gas filled tungsten	Irving Langmuir	American
1935	Radar parts	R. Watson-Watt	Scottish

Construction



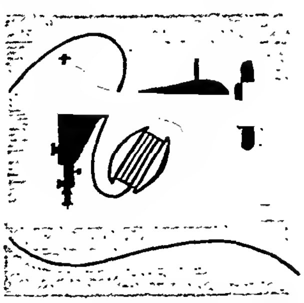
Date	Invention	Inventor	Nationality
1756	Hydraulic cement	John Smeaton	English
1824	Portland cement	Joseph Aspdin	English
1839	Steam hammer	James Nasmyth	Scottish
1860	Cylinder lock	Linus Yale	American
1884	Skyscraper con-struction	W. L. Jenney	American
1891	Carborundum	E. G. Acheson	American
1911	Air conditioning	W. H. Carrier	American

Science



Date	Invention	Inventor	Nationality
1590	Compound microscope	Zacharias Janssen	Dutch
1593	Thermometer	Galileo	Italian
1608	Telescope	Hans Lippershey	Dutch
1609	Refracting telescope	Galileo	Italian
1643	Barometer	Evangelista Torricelli	Italian
1656	Pendulum clock	Christian Huygens	Dutch
1668	Reflecting telescope	Isaac Newton	English
1714	Thermometer	Gabriel D. Fahrenheit	German
1733	Achromatic lens	Chester M. Hall	English
1749	Marine chronometer	John Harrison	English
1760	Bifocal spectacles	B. Franklin	American
1792	Illuminating gas	William Murdock	Scottish
1796	Vaccination	Edward Jenner	English
1819	Stethoscope	René Laënnec	French
1820	Hygrometer	J. F. Daniell	English
1831	Chloroform anesthesia	Samuel Guthrie	American
1842	Ether anesthesia	Crawford Long	American
1852	Gyroscope	J. B. L. Foucault	French
1855	Bunsen burner	Robert Bunsen	German
1869	Antiseptic surgery	Joseph Lister	English
1885	Welsbach (gas) mantle	K. A. von Welsbach	Austrian
1931	Cyclotron	E. O. Lawrence	American
1940	Betatron	D. W. Kerst	American

Cloth and Clothing



Date	Invention	Inventor	Nationality
1589	Knitting machine	William Lee	English
1733	Flying shuttle	John Kay	English
1764	Spinning jenny	J. Hargreaves	English
1769	Spinning frame	R. Arkwright	English
1779	Spinning mule	Samuel Crompton	English
1785	Power loom	E. Cartwright	English
1793	Cotton gin	Eli Whitney	American
1800	Jacquard loom	J. M. Jacquard	French
1823	Mackintosh (raincoat)	C. Macintosh	Scottish
1830	Sewing machine	B. Thimonnier	French
1839	Rubber vulcanization	C. Goodyear	American
1844	Mercerized cotton	John Mercer	English
1845	Sewing machine	Elias Howe	American
1874	Shoe welt stitcher	C. Goodyear, Jr.	American
1893	Zipper	W. L. Judson	American
1896	Rubber heel	H. O'Sullivan	American
1936	Cotton-picking machine	John and Mack Rust	American

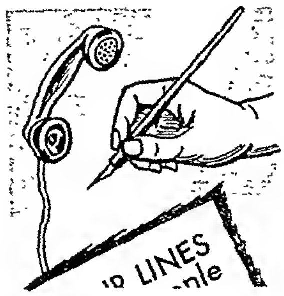
Food Processing

Date	Invention	Inventor	Nationality
1701	Seed drill	Jethro Tull	English
1786	Thresher	Andrew Meikle	Scottish
1789	Soda from salt	N. Leblanc	French
1797	Cast-iron plow	Charles Newbold	American
1804	Canning	François Appert	French
1830	Ice-making machine	Jacob Perkins	American
1831	Reaper	Cyrus McCormick	American
1837	Steel plow	John Deere	American
1851	Refrigerating machine	John Gorrie	American
1853	Condensed milk	Gail Borden	American
1858	Refrigerator	Ferdinand Carré	French
1861	Soda from salt	Ernest Solvay	Belgian
1874	Refrigerator	Carl von Linde	German
1877	Refrigerator car	G. F. Swift	American
1890	Milk test	S. M. Babcock	American
1925	Quick-frozen food	C. Birdseye	American

Calculating and Record-keeping Machines

Date	Invention	Inventor	Nationality
1642	Adding machine	Blaise Pascal	French
1830	Platform scales	Thaddeus Fairbanks	American
1879	Cash register	James Ritty	American
1885	Comptometer	Dorr E. Felt	American
1888	Adding machine	W. Burroughs	American

Communication



Date	Invention	Inventor	Nationality
1725	Stereotyping	William Ged	Scottish
1780	Steel pen	Samuel Harrison	English
1795	Hydraulic press	Joseph Bramah	English
1796	Lithography	Alois Senefelder	German
1798	Papermaking machine	N. L. Robert	French
1810	Printing press	Frederick Koenig	German
1829	Typewriter	W. A. Burt	American
1829	Braille printing	Louis Braille	French
1832	Stereoscope	C. Wheatstone	English
1835	Calotype photography	Henry F. Talbot	English
1837	Telegraph	S. F. B. Morse	American
1839	Daguerreotype photography	Louis Daguerre J. N. Niepce	French French
1840	Blueprint	John Herschel	English
1846	Rotary printing press	Richard M. Hoe	American
1865	Web-fed rotary press	William Bullock	American
1868	Typewriter	C. L. Sholes	American
1871	Dry-plate process in photography	R. L. Maddox	English
1876	Telephone	A. G. Bell	American
1877	Phonograph	T. A. Edison	American
1878	Microphone	D. E. Hughes	American
1883	Linotype	O. Mergenthaler	American
1884	Fountain pen	L. E. Waterman	American
1884	Flexible roll film	George Eastman	American
1886	Halftone engraving	F. E. Ives	American
1887	Monotype	Tolbert Lanston	American
1888	Kodak camera	George Eastman	American
1893	Movie projector	T. A. Edison	American
1895	Movie projector	Thomas Armat	American
1896	Wireless telegraphy	G. Marconi	Italian
1904	Telephotography	Arthur Korn	German
1904	Diode	J. A. Fleming	English
1906	Audion	Lee De Forest	American
1918	Superheterodyne radio circuit	E. H. Armstrong	American
1922–26	Sound motion pictures	T. W. Case	American
	Television		
1908	Conceived by	A. A. C. Swinton	Scottish
1923	Iconoscope	V. Zworykin	American
1925	Televisor	John L. Baird	Scottish
1928	Image dissector	P. Farnsworth	American
1931	CinemaScope	Henri Chretien	French
1933	Frequency modulation	E. H. Armstrong	American
1939	Cinerama	Fred Waller	American

I'O. As told in Greek mythology, Io the beautiful maiden, daughter of Inachus, king of Argos, was beloved by Zeus (Jupiter). To protect the maiden from the jealousy of Hera his wife, Zeus changed Io into a white heifer. But Hera was not deceived and appointed the giant Argus, who had a hundred eyes, to watch over her. Hermes (Mercury), the winged god, sent by Zeus to carry off the heifer, slew Argus, first charming him to sleep by playing the flute and then cutting off his head. Hera used the eyes of Argus to decorate the tail of the peacock, her sacred bird. The jealous goddess, not yet satisfied, sent a gadfly to torment Io, who fled without a moment's rest, until finally she was restored to human form.

IODINE. The drug iodine and its many compounds are sometimes used in the internal treatment of rheumatism, pleurisy, Bright's disease, asthma, bronchitis, goiter, and in chronic lead and mercury poisoning. Iodine is used in many forms as a disinfectant and antiseptic. As a counterirritant, it relieves pain and congestion. Iodoform, which produces the unpleasant sweetish odor sometimes present in hospitals, is a compound of carbon, hydrogen, and iodine. It is used as an antiseptic in surgical dressings.

Iodine is the main constituent of thyroxin, the active part of the thyroid gland, and a lack of iodine tends to promote goiter. Iodine occurs in seaweed, sea water, fish, and in the air about salt water. There is little goiter near seacoasts or among people who eat much sea food. In inland regions, however, such as Switzerland and the Great Lakes regions of the United States, goiter is endemic—that is, it is always present. Iodized salt, which is common table salt with a trace of alkaline iodide, is prescribed as a preventive of goiter.

Most of the world's iodine comes as a by-product from the nitrate beds of Chile. The "air nitrates"—synthetic nitrates—are deficient in iodine, and their use in fertilizers has brought an increase in goiter in both men and animals. As a remedy, producers of synthetic nitrate urge that more fish be used as food for both humans and animals and that it be added to fertilizers, since sea foods contain from 50 to 200 times as much iodine as other foods.

Commercial quantities of iodine are secured from seaweed in France, Scotland, Norway, Japan, and Indonesia. No iodine was produced in the United States until some years ago. Now it is recovered from waste oil-field brines.

Iodine is known in chemistry as one of the four halogens, the others being chlorine, bromine, and fluorine. Its chief compounds, called iodides, are formed with various metals. Pure iodine is a crystalline substance which turns to heavy purple vapor when heated to 184° F. Iodine is used in chemical analysis, particularly in volumetric procedure.

It was discovered in 1811 by Bernard Courtois, of Paris, who was treating seaweed to get saltpeter for the manufacture of gunpowder for Napoleon's army. The antidote for iodine poisoning is starch water.

Electrified IONS *and What They* DO

IONS AND IONIZATION. Many important relations exist between certain kinds of matter and electricity. Metals transmit electric current readily. The soluble substances called acids, bases, and salts are excellent conductors when dissolved in water. But most insoluble substances are poor conductors. Among them are glass, petroleum products, and rubber.

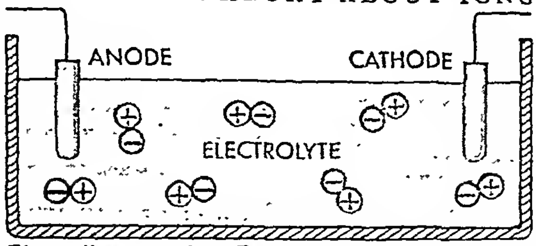
In 1834 the English scientist Michael Faraday explained how conducting solutions worked, using what he knew about charges of electricity. Two kinds exist, called positive (+) and negative (—). Unlike charges (that is, + and —) attract each other (*see* Electricity). An electric current is a passage of charge through a conductor. With these known facts, Faraday developed the theory pictured at the right.

Faraday called the conducting solution an *electrolyte*. The word comes from Greek terms and means "things loosened by electricity." The plates or rods which pass current into and out of the solution he called *electrodes*. The one with positive (+) charge is the *anode*. The negative (—) one is the *cathode*. He named the separated, charged parts of the molecules *ions*. The word is from Greek and means "things that go" or "travelers." The negative ions which go to the anode (+ pole) are called *anions;* the others are *cations*.

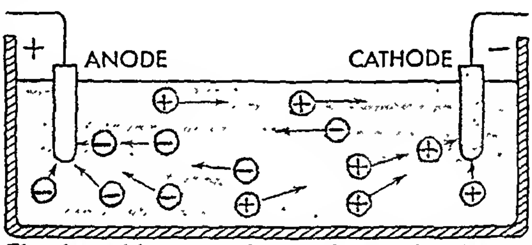
The Modern Theory

In 1884 a young Swedish chemist, Svante August Arrhenius, developed Faraday's theory greatly. He proved that in electrolytes a certain portion of the molecules break up (dissociate) and gain charges when the substance is dissolved in water. This happens, moreover, whether an electric current is applied or not. In nonelectrolytes molecules do not dissociate.

FARADAY'S THEORY ABOUT IONS

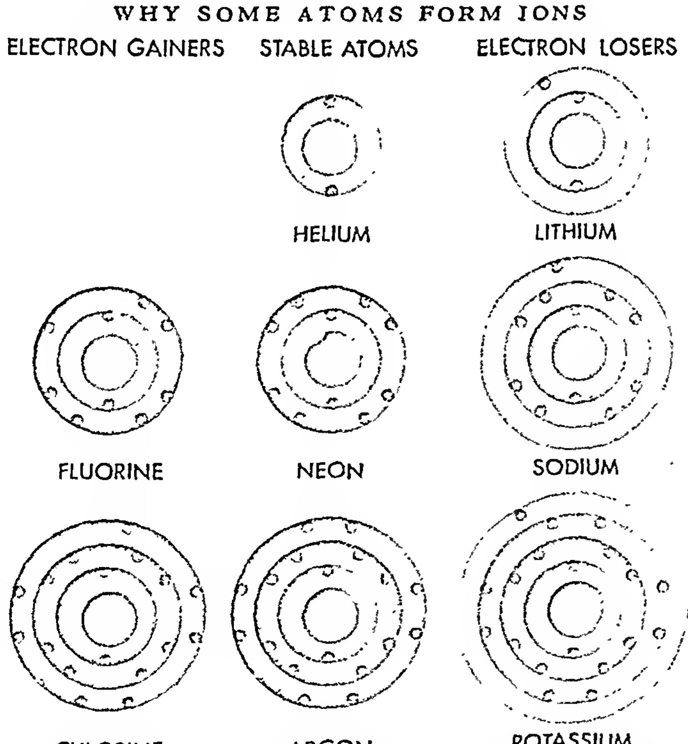


These diagrams show Faraday's explanation of how electric current passes through solutions of acids, bases, and salts. When electric charges are applied to the solution through the electrodes (anode and cathode) the molecules of the dissolved substances break in two. The parts acquire positive (+) and negative (—) charges as shown. In this condition they are called *ions*.



The charged ions obey the rule that "unlike charges attract." Ions with negative (—) charge (*anions*) move through the solution (called the *electrolyte*) to the anode with its positive (+) charge. Positively charged ions (*cations*) move toward the cathode.

WHY SOME ATOMS FORM IONS



Here are simple examples of why atoms do or do not ionize. In the middle are electrically stable atoms, with two or eight *electrons in the outer* shell. They have no tendency to gain or lose electrons, and never ionize. Those to the left tend to gain a stable outer shell of eight electrons, by adding one to the seven they have. Those on the right tend to lose the outermost electron. Either change charges (ionizes) the atom.

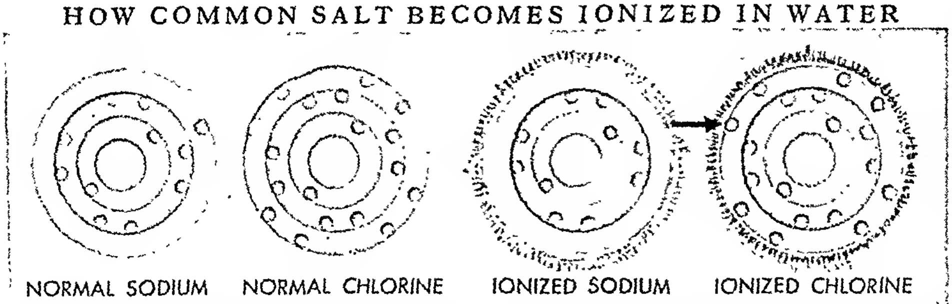
The explanation for this appeared after 1900 when the electrical nature of the atom was discovered. According to the modern view, any atom has one or more positively charged particles called *protons* in its core or *nucleus*, and an equal number of negatively charged *electrons* around the nucleus (*see* Atoms). In the nonionized state, the two kinds of charges balance, and the atom is electrically neutral. But in many kinds of atoms, this balance can be upset and the atom may become charged.

Among the lighter elements, certain ones are extremely stable. They show no tendency to acquire electrical charge. One kind is the atom of helium, with two electrons as its outer shell. But other kinds, which have slightly more or less than the stable number, will gain or lose electrons until they achieve such a number. Among these elements, lithium, sodium, and potassium each have one electron in the outer shell, and readily lose it. Fluorine and chlorine each have seven outer electrons. They will gain one to make eight in all. These structures are shown at the left.

Before such gain or loss can occur, the atoms must be near charges which aid the change. When atoms with opposite tendencies are placed in water, they can transfer electrons readily. A simple example is shown on the next page.

Ionization can occur also in gases if strong charges are applied. Atoms in the air are ionized by the charges

HOW COMMON SALT BECOMES IONIZED IN WATER



The two atoms in a molecule of common salt are made up of negatively charged (—) electrons (blue) and a positively charged (+) nucleus (orange). A normal (nonionized) sodium atom has one outer electron. A normal chlorine atom has seven. These and all other electrons in each atom are balanced by an equal number of (+) charges in the nucleus. Therefore each atom is electrically neutral.

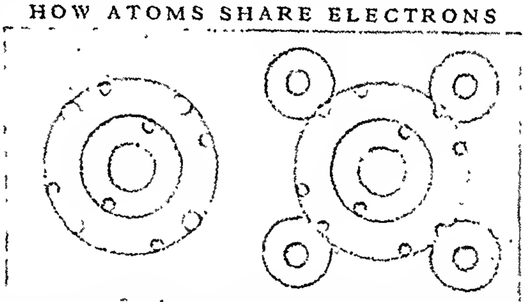
When common salt is dissolved in water, the sodium and chlorine atoms break apart (*dissociate*). Then each atom gains an outermost shell of eight electrons. The sodium atom does so by losing its outer electron. The chlorine atom takes in an extra electron. Thus sodium is left with an excess (+) charge, and chlorine an excess (—) charge. The atoms have become sodium and chlorine *ions*.

which produce lightning (*see* Lightning). A gas can be ionized by strong charges in a vacuum tube and by the devices called "atom smashers."

Electrical and Chemical Properties of Ions

Once the loss or gain occurs, positive charges in the nucleus are no longer balanced by an equal number of electrons, and the atom becomes an ion, with electric charge. These electrified states are shown in formulas with + and — signs. Lithium, sodium, and potassium ions are shown as Li^+, Na^+, and K^+. Fluorine and chlorine ions are F^- and Cl^-.

HOW ATOMS SHARE ELECTRONS



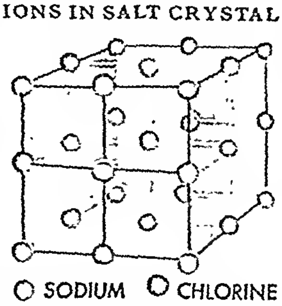
Here (left) is an atom of carbon, with two innermost electrons and four in the outer shell. It cannot gain or lose electrons outright to achieve an outermost shell of eight. But it can share its electrons with four atoms of hydrogen, and share also in their electrons. This gives a sort of eight-electron shell for carbon and two for each hydrogen atom. Each pair of shared electrons is a *covalent bond.* The compound CH_4 is methane (marsh gas).

When atoms become ions, their characteristics change. For example, the two elements in common salt are each poisonous in their normal state. Pure sodium reacts violently enough with water to explode. Normal chlorine is a poisonous gas. But sodium and chlorine ions are not only harmless; they are indispensable to life. Men and animals eat salt to get them.

Other Examples of Ionization

Various kinds of atoms achieve a stable form in other ways than those described. Iron, for example, will give up two, three, or more electrons to other atoms. When it lends electrons to oxygen, it forms either of two different compounds, called ferrous oxide (FeO) and ferric oxide (Fe_2O_3). The case of the metal manganese is even more complex. It combines with oxygen in no less than five different odd ways.

IONS IN SALT CRYSTAL



Sodium and chlorine ions form a latticework with each ion equidistant from all others with unlike charge. This picture shows a small part of such a crystal.

The reasons for this kind of behavior are not well understood. Some scientists think that the outer electrons in such atoms are capable of arranging themselves in various ways. If this is true, it would account for the ability of these atoms to release different numbers of electrons.

Often two or more elements act as a chemical group (*radical*) within a compound, and some atom in the group may become ionized. When the compound dissociates, the radical acts as an ion. Sodium hydroxide (lye, NaOH), for example, breaks into Na^+ and OH^- (the hydroxyl ion). Sulphuric acid (H_2SO_4) dissociates into the ions H^+, H^+, and SO_4^{--} (sulphate ion).

Covalent Bonds in Nonionizing Atoms

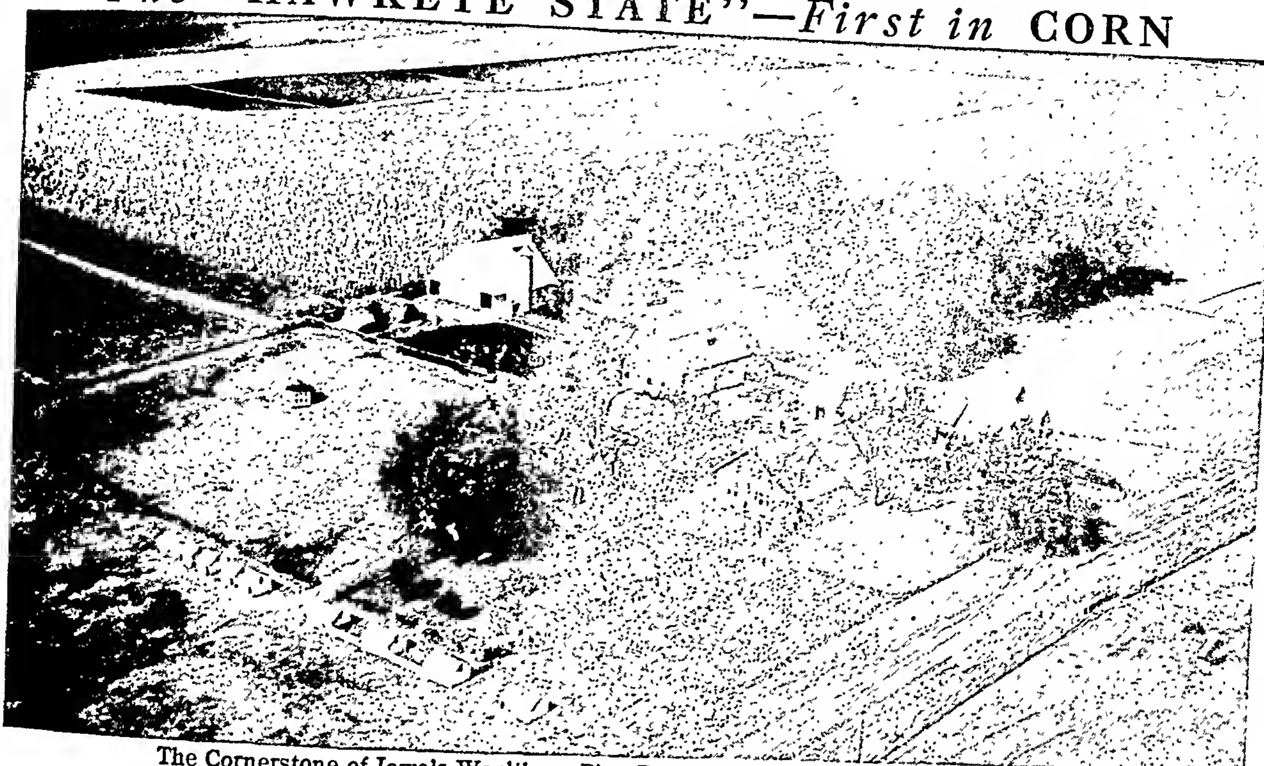
The atom of hydrogen, lightest of the elements, is an extremely important type. It has only one proton as a nucleus, and an outer shell of one electron. It is too light to capture another electron and gain an outer shell like that of helium. Hence it ordinarily ionizes by losing its electron and becoming a positive ion (H^+). But it can gain a sort of two-electron shell in another way. To do this, the hydrogen atom *shares* its electron with another atom. The other atom also shares one of its electrons with the hydrogen atom. Thus each atom has a share in two electrons, instead of its single one, and this tends to satisfy its needs. The shared pair is called a *covalent bond.* An example is shown in the adjoining picture. Many kinds of atoms form covalent bonds instead of ionizing.

Ions and Crystallization

Ionization figures prominently in the formation of crystals from *electrovalent* substances—that is, substances which ionize. Formerly, it was thought that in such a crystal, the chemical elements of the substance formed molecules, and these were joined to form the crystal. Today it seems that the elements are ionized, and the ions are united in a latticelike arrangement to make the crystal.

A good example is a crystal of common salt. Formerly the sodium and chlorine were thought to unite in simple molecules (NaCl). Today scientists think the crystal is formed of sodium and chlorine ions, as shown in the accompanying diagram.

The "HAWKEYE STATE"—First in CORN



The Cornerstone of Iowa's Wealth—a Fine Farm Homestead Set in a Sea of Corn

IOWA. Very few investments have paid the United States as well as Iowa. Its 56,290 square miles of area constitute only a small fraction of the Louisiana Purchase. The entire purchase cost about $15,-000,000. Suppose one million dollars represented the amount the United States paid France for what is now Iowa. Every year the value of the Iowa farmers' corn crop alone is about 600 times as much. The total value of Iowa's farm products exceeds 2 billion dollars. This is about five times what the United States spent to complete the Panama Canal.

Iowa is in the heart of the North Central group of states. It lies between the two great rivers of the Midwest—the Mississippi on the east and the Missouri on the west. To the north is Minnesota and to the south, Missouri.

A Gently Rolling Prairie

The entire state is located upon the fertile prairies of the Central Lowlands region. Thus Iowa's surface is virtually flat. But to the eye it seems rolling, because the rivers carved shallow valleys across the land. But almost everywhere the soil was flat enough for the plows of the first settlers. The chief breaks in this level sweep of land are the steep bluffs which rise from the Mississippi, and the low knoblike hills in the southwestern corner. Many scenic lakes were left in the northwest by glaciers ages ago.

From Osceola County in the northwest the land slopes gently toward the southeast and southwest. The rivers of the state generally follow this slope. The Cedar, Iowa, Des Moines, and other streams in the eastern two-thirds of the state flow southeast into the Mississippi. In the west, the Little Sioux, Big Sioux, and Floyd drain southwest into the Missouri.

Fertile Soil and Favorable Climate

Iowa is one of the great farming regions of the world. Of all the soil in the United States classified as Grade "A," or excellent, Iowa has one fourth. Out of every hundred acres in the state, 96 are in farms. Of these, 76 are suitable for crops and 66 are actually cultivated. Compare these figures with those of the nation—61 acres out of every hundred in farms, only 41 suitable for crops, and but 30 are actually cultivated.

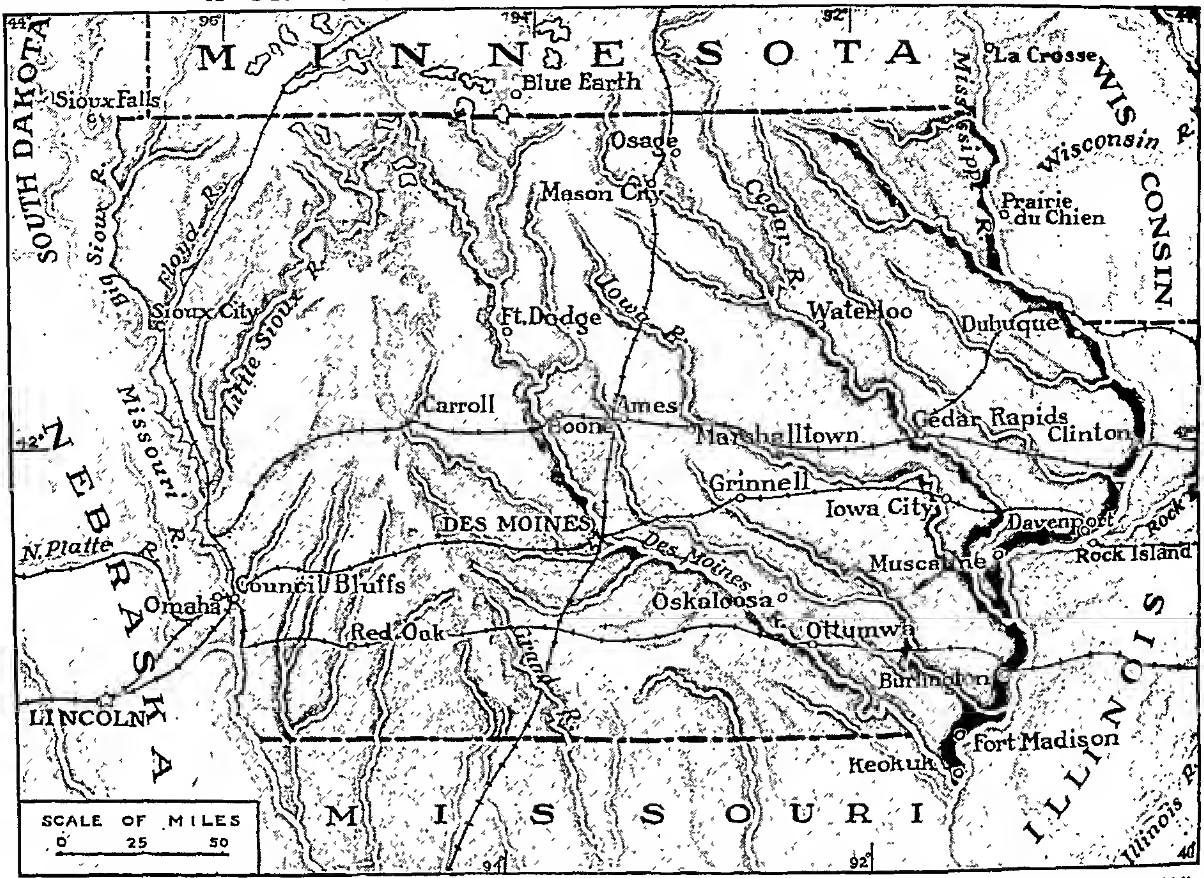
In North Central Iowa the remarkable fertility of the soil is due chiefly to the great glaciers which carpeted the region with a powdery drift of sand, gravel, and clay. Equally fertile is the loess, or wind-blown silt, which covers most of the state outside the drift area. A third type of soil was made by rich alluvial deposits on the bottomlands of the larger rivers. Through the centuries prairie grass added tons of humus which colored Iowa's topsoil a dark brown or black (*see* Soil).

In addition to fine soil, Iowa has a splendid climate for growing food crops. The annual precipitation of about 31 inches is ample, and more than half falls when it is needed most—March through July. On many summer days temperatures range from 80°F. to 90°—ideal for ripening crops. Normally there are no killing frosts from March until late October. Thus the growing season is long enough for all grains.

"Where the Tall Corn Grows"

Iowa produces about one fifth of the nation's corn and the yearly value of this crop is greater than the

A GREAT STOREHOUSE OF NATURE'S BOUNTY



Lying between the Missouri and Mississippi rivers, Iowa's rich black soil—some of the finest farming land in the Middle West—is watered by the countless tributaries of these great streams. Notice the divide between the river systems in the west.

total national income of many European countries. Much of this high yield is due to the planting of sturdy hybrid seed corn and careful use of the soil. Farmers maintain the fertility of their fields by crop rotation—alternating grain crops with legumes such as clover—or they let the land "rest" in pasture for a year or more. Farmers also enrich the soil with manure and commercial fertilizers. This scientific farming enables Iowa fields to average as high as 60 bushels of corn to the acre in contrast to the best national average of about 43 bushels to the acre.

Most of this huge crop is used to fatten hogs and cattle for market. Iowa raises about one fifth of the nation's hogs, more than any other two states. It also is a leader in producing grain-fed beef. Abundant corn and rich pasture lands combine to make northeastern Iowa an important dairying center.

In addition to corn, hogs, and cattle, Iowa yields many other agricultural products. It ranks first or near the top in the production of oats, soybeans, butter, chickens, and eggs. The state raises about one fifth of the popcorn grown in the United States. It also stands high in hay production and usually raises about one half of the nation's timothy seed.

Manufacturing Based on Agriculture

Iowa has no large industrial areas like those found in many states. Instead, its factories, mills, and plants are decentralized; that is, located in small cities scattered throughout the state.

The manufacturing industries are closely allied to the agricultural economy of the state. The most important industry is the processing of food products from Iowa farms. Meat packing accounts for much of this production. The manufacture of grain-mill, corn, dairy, and bakery products is also important.

Another large industry related to agriculture is the manufacture of machinery. Many tractors and other farm machines are made for local use and for shipment to other states. Laundry equipment and construction and mining machinery are also manufactured here. Other valuable industries are the printing and publishing of farm newspapers and magazines and the manufacture of soybean oil, paint, and drugs.

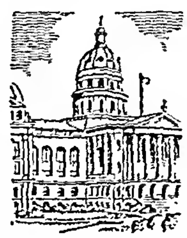
Within the state are about 8,600 miles of railroad. This gives Iowa more track mileage than any other state west of the Mississippi River except Texas. Part of this huge steel network is the result of Iowa's central position astride the transcontinental lines running between the eastern seaboard and the Far West. From these railways small "feeder" lines branch north and south to reach into every county. No point in the state is more than 12.8 miles from a railroad. Supplementing the railroads are thousands of miles of fine highways and improved secondary

Continued on page 210

Iowa Fact Summary

IOWA (no abbr.): Origin of name uncertain; probably from Indian word meaning "this is the place."
Nickname: "Hawkeye State," from name of guide in 'The Last of the Mohicans' by James F. Cooper. Term "Hawkeyes" first applied by James G. Edwards, editor of *Burlington Hawkeye.*
Seal: A sheaf and field of standing wheat; farm tools; citizen soldier near plow; lead furnace.
Motto: Our Liberties We Prize, and Our Rights We Will Maintain.
Flag: For description and illustration, *see* Flags.
Flower: Wild rose. **Bird:** Eastern goldfinch. **Tree:** None official. **Song:** 'Song of Iowa'—words, S. H. M. Byers; tune, 'O Tannenbaum'.

THE GOVERNMENT



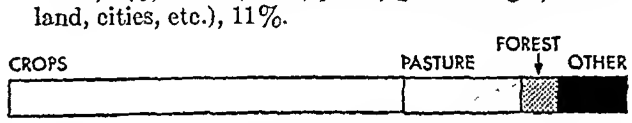
Capital: Des Moines (since 1857).
Representation in Congress: Senate, 2; House of Representatives, 8. Electoral votes, 10.
General Assembly: Senators, 50; term, 4 years. Representatives, 108; term, 2 years. Convenes 2d Mon. in Jan. in odd years. No limit to sessions.
Constitution: Adopted 1857. Proposed amendment must be (a) passed by majority vote of both legislative houses at 2 successive sessions and (b) ratified by a majority voting on amendment at a popular election.
Governor: Term, 2 years. May succeed himself.
Other Executive Officers: Lieut. gov., secy. of state, atty. gen., auditor, treasr., secy. of agriculture, all elected; term, 2 years. Supt. of public instruction, elected until 1955, then appointed by board of public instruction with Senate approval; term, 4 years. Commerce commission, 3 members elected; term, 4 years.
Judiciary: Supreme court—9 justices, elected at large; term, 6 years. District courts—21; judges elected; term, 4 years. Municipal and superior courts—as authorized by General Assembly; judges elected; term, 4 years.
County: 99 counties, each governed by a board of 3 or 5 members (in 2 counties the number is 7); boards elected; term, 3 years; officers elected; term, 2 years.
Municipal: 4 plans—mayor-council, special charter, commission, and city manager.
Voting Qualifications: Age, 21; residence in state, 6 months; in county, 60 days; in district, 10 days.

TRANSPORTATION AND COMMUNICATION

Transportation: Railroads, 8,600 miles. First railroad, Miss. & Mo. (Davenport to Muscatine), now part of Chicago, Rock Island, 1855. Rural roads, 101,100 miles. Airports, 166.
Communication: Periodicals, 100. Newspapers, 472. First newspaper, *Du Buque Visitor*, Dubuque, 1836. Radio stations (AM and FM), 68; first station, WOC, Davenport, licensed Feb. 18, 1922. Television stations, 4; first station, WOC-TV, Davenport, began operation Oct. 31, 1949. Telephones, 889,600. Post offices, 1,096.

THE PEOPLE AND THEIR LAND

Population (1950 census): 2,621,073 (rank among 48 states—22d); urban, 47.7%; rural, 52.3%. Density: 46.8 persons per square mile (rank—27th state).
Extent: Area, 56,290 square miles, including 245 square miles of water surface (24th state in size).
Elevation: Highest, near Sibley, 1,675 feet; lowest, Mississippi River at Lee County, 480 feet.
Temperature (°F.): Average—annual, 49°; winter, 22°; spring, 48°; summer, 72°; fall, 51°. Lowest recorded, −47° (Washta, Jan. 12, 1912); highest recorded, 118° (Keokuk, July 20, 1934).
Precipitation: Average (inches)—annual, 31; winter, 3; spring, 8; summer, 12; fall, 8. Varies from about 26 in the northwest to about 36 in southeast and east.
Natural Features: Rolling prairie land gently rising from low level in Lee County in southeast to higher levels in north and west; cliffs rise abruptly along banks of the Mississippi in northeastern section; moundlike bluffs swell up in the west, south of the mouth of the Big Sioux River. Chief rivers: Big Sioux, Cedar, Des Moines, Iowa, Mississippi, Missouri.
Land Use: Cropland, 64%; nonforested pasture, 19%; forest, 6%; other (roads, parks, game refuges, wasteland, cities, etc.), 11%.



Natural Resources: *Agricultural*—very fertile soil; adequate precipitation; long growing seasons. *Industrial*—bituminous coal mines; clay, limestone, sand and gravel, stone, cement, and gypsum; plentiful water power. *Commercial*—abundance of crops and livestock basis for meat-packing and farm-products industries.

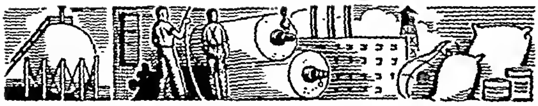
OCCUPATIONS AND PRODUCTS

What the People Do to Earn a Living

Major Industries and Occupations, 1950

Fields of Employment	Number Employed	Percentage of Total Employed
Agriculture, forestry, and fishery	285,636	28.6
Wholesale and retail trade	192,366	19.2
Manufacturing	151,984	15.2
Professional services (medical, legal, educational, etc.)	87,573	8.7
Transportation, communication, and other public utilities	69,413	6.9
Construction	54,954	5.5
Personal services (hotel, domestic, laundering, etc.)	44,392	4.4
Government	30,238	3.0
Finance, insurance, real estate	27,639	2.8
Business and repair services	26,465	2.6
Amusement, recreation, and related services	8,275	0.8
Mining	3,221	0.3
Workers not accounted for	20,024	2.0
Total employed	1,002,180	100.0

Iowa Fact Summary



What the People Produce

A. Manufactured Goods (Rank among states—22d)
Value added by manufacture* (1952), $1,113,171,000

Leading Industries in 1947 (with Principal Products)	Value Added by Manufacture	Rank among States
FOOD AND KINDRED PRODUCTS..... Meat packing; grain-mill products; corn products; bakery products; dairy products	$228,710,000	14
MACHINERY (EXCEPT ELECTRICAL). Tractors and farm machinery; domestic laundry equipment; construction and mining machinery	143,421,000	12
PRINTING AND PUBLISHING........ Newspapers; periodicals	55,385,000	15
CHEMICALS AND ALLIED PRODUCTS. Soybean oil mills; paints and varnishes; drugs and medicines	50,977,000	23
FABRICATED METAL INDUSTRIES... Structural metal products; heating and plumbing equipment	27,649,000	21

*For explanation of value added by manufacture, *see* Census.

B. Farm Products (Rank among states—2d)
Total cash income (1952), $2,214,238,000

Products	Amount Produced (10-Year Average)	Rank within State*	Rank among States†
Hogs...........	4,013,312,000 lbs.	1	1
Corn...........	533,540,000 bu.	2	1
Cattle..........	1,578,826,000 lbs.	3	2
Milk...........	3,061,000,000 qts.	4	4
Oats...........	198,417,000 bu.	5	1
Eggs...........	328,000,000 doz.	6	1
Hay...........	5,474,000 tons	7	5
Soybeans.......	30,709,000 bu.	8	2
Chickens.......	242,051,000 lbs.	9	1
Sheep and lambs	87,041,000 lbs.	10	7

*Rank in dollar value †Rank in units produced

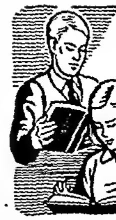
C. Minerals (Fuels, Metals, and Stone)
Annual value (1951), $47,706,000
Rank among states—34th

Minerals (1951)	Amount Produced	Value
Cement.................	8,025,000 bbls.	$19,800,000
Stone..................	9,261,000 tons	12,170,000
Coal..................	1,630,000 tons	6,110,000
Sand and gravel.........	9,943,000 tons	5,917,000
Gypsum................	1,128,000 tons	2,881,000

D. Trade

Trade (1948)	Sales	Rank among States
Wholesale..........	$3,366,206,000	13
Retail............	2,556,224,000	14
Service............	164,709,000	22

EDUCATION



Public Schools: Elementary, 4,658; secondary, 829. Compulsory school age, 7 through 16. State board of public instruction, 8 members elected by conventions, 1 member appointed by governor (senate approves); term, 6 yrs. Supt. of public instruction elected until 1955, then appointed by state board (senate approves); term, 4 yrs. County school boards of 5 members elected; term, 5 yrs.; appoint county supts.—term, 3 yrs. City school board members elected; city supts. elected; term, 1 yr., then eligible for 3-year term.

Private and Parochial Schools: 363.

Colleges and Universities (accredited): Colleges, 25; junior colleges, 23. State-supported schools include the State University of Iowa, Iowa City; Iowa State College of Agriculture and Mechanic Arts, Ames; Iowa State Teachers College, Cedar Falls.

Special State Schools: Iowa School for the Deaf, Council Bluffs; Iowa School for the Blind, Vinton; Woodward State Hospital School, Woodward, and Glenwood State School, Glenwood, both for the feeble-minded; Annie Wittenmeyer Home, Davenport, for soldiers' orphans; Iowa Juvenile Home, Toledo.

Libraries: City and town public libraries, 369; independent county library systems, 3; 3 counties contract for service with city libraries. State Traveling Library responsible for aid in developing library service.

Outstanding Museums: Museum of Natural History, State University of Iowa, Iowa City; Municipal Art Gallery, Davenport; Public Museum, Davenport; Iowa State Historical Building, Des Moines.

CORRECTIONAL AND PENAL INSTITUTIONS

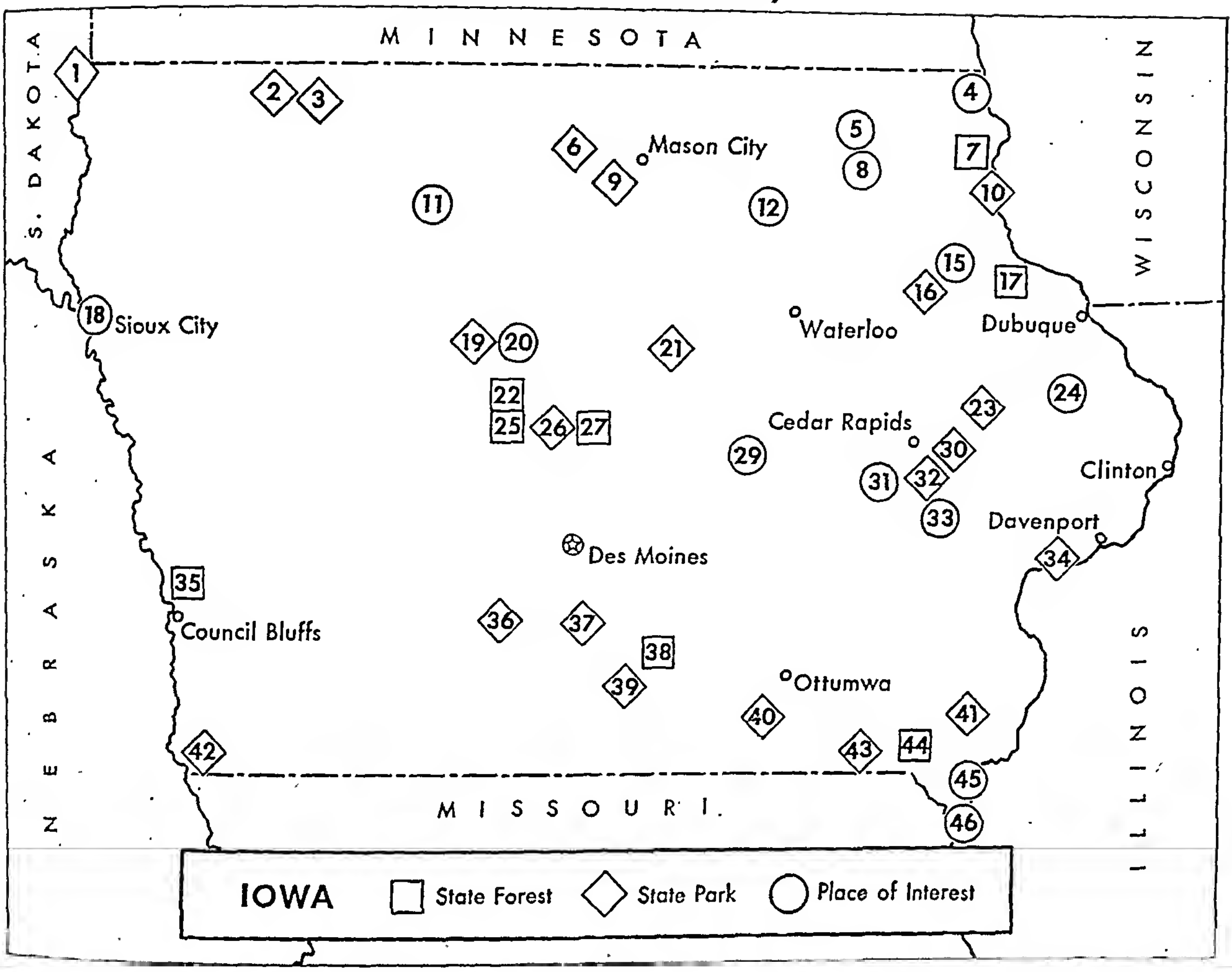
Iowa Training School for Boys, Eldora; Iowa Training School for Girls, Mitchellville; State Reformatory for Men, Anamosa; State Reformatory for Women, Rockwell City; State Penitentiary, Fort Madison.

PLACES OF INTEREST*

Amana—communal town founded by Amana Soc. (31).
Anton Dvořák Memorial—in Spillville; village where the Bohemian composer lived for a time (5).
Bixby State Monument—ice cave; near Edgewood (15).
Effigy Mounds National Monument—Indian mounds in shape of birds and animals; near symbol (10).
Fish Farm Indian Mound Group—about 30 Indian burial mounds, as yet unopened; near Lansing (4).
Fort Atkinson—remains of early military post (8).
Galland—site of first Iowa schoolhouse (45).
Grotto of the Redemption (West Bend)—shells, coral, fossils from many places used in its building (11).
Iowa City—home of Robert Lucas, 1st territorial governor; Old Capitol on State University campus (33).
Keokuk Dam—about 1 mile long on Mississippi R. (46).
Little Brown Church in the Vale—known through popular hymn of the same name; near Nashua (12).
Maquoketa Caves—natural bridge with 40- to 50-foot arch; 17-ton balanced rock; limestone caves (24).
Sioux City—band shell in natural amphitheater; grave of Charles Floyd, of Lewis and Clark Expedition (18).
Tama Indian Reservation—Sauk (Sac) and Fox tribes on only Indian reservation in Iowa (29).
Woodman Hollow—near Fort Dodge; a deep gorge carved into sandstone by Des Moines River (20).

*Numbers in parentheses are keyed to map.

Iowa Fact Summary



STATE PARKS AND RESERVES*†

Backbone—limestone bluffs, 90 to 140 feet high, along Maquoketa River give area its name (16).
Blackhawk—statue of Indian chief, Blackhawk; state's largest fish-rearing ponds; southwest of (19).
Clear Lake—spring-fed lake stocked with fish (9).
Dolliver Memorial—Indian mounds; deep ravines (19).
Geode—spheres of rock with quartzlike centers (41).
Gitchie Manitou—earliest types of wild grasses preserved; Jasper Pool, noted for its peculiar color (1).
Lacey-Keosauqua—lake, ravines, cliffs (43).
Lake Ahquabi—recreational area; rustic buildings (37).
Lake Macbride—lake stocked with fish (32).
Lake Wapello—fishing in large artificial lake (40).
Ledges—sandstone walls rise 25 to 75 feet (26).
Okoboji Region—5 separate lake reserves; Spirit Lake Massacre Monument and Gardner Cabin (3).
Palisades-Kepler—limestone cliffs, 30 to 70 feet (30).
Pammel—unusual vertical limestone ridge; important for nature study; Iowa's only highway tunnel (36).
Pike's Peak—mounds and colored sand cliffs (10).
Pilot Knob—glacial formation; many native hardwoods and open-air amphitheater (6).
Pine Lake—Indian mounds and relics found here (21).
Preparation Canyon—views from high ridges; Mormons settled here 1850's, then moved west; n. of (35).
Red Haw Hill—hawthorne trees; game preserve (39).
Trappers Bay—camp site of early Indian trappers (2).
Wapsipinicon—Horsethief Cave, chief attraction (23).
Waubonsie—views from heights; many hiking trails (42).
Wild Cat Den—old gristmill; many small caves (34).

STATE FORESTS*

Backbone (Dubuque County)—120 acres; west of (17).
Holst (Boone County)—333 acres (25).
Petrus Memorial (Pottawattamie Co.)—100 acres (35).
Pilot Mound (Boone County)—33 acres (22).
Shimek (Lee and Van Buren Cos.)—3,721 acres (44).
State Forest Nursery (Story County)—100 acres (27).
Stephens (Lucas and Monroe Cos.)—4,241 acres (38).
White Pine Hollow (Dubuque County)—650 acres (17).
Yellow River (Allamakee County)—4,206 acres (7).

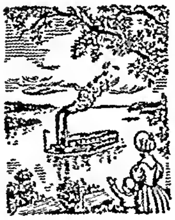
LARGEST CITIES (1950 census)

Des Moines (177,965): state capital; heart of rich agricultural area; insurance center; farm publications; meat packing; manufactures farm machinery.
Sioux City (83,991): livestock and grain market; meat packing; manufactures machinery, tools, and batteries.
Davenport (74,549): shipping point for farm products; makes farm implements, locomotives, sheet aluminum.
Cedar Rapids (72,296): industrial and wholesale hub; cereal mills; meat packing; makes radio parts.
Waterloo (65,198): meat packing; produces farm machinery, washing-machine parts, concrete mixers.
Dubuque (49,671): large farm-products market; woodworking; farm machinery; meat packing.
Council Bluffs (45,429): makes truck bodies, elevators.
Ottumwa (33,631): food processing and meat packing.
Burlington (30,613): docks; Iowa Ordnance Plant.
Clinton (30,379): railroad center; corn products.

*Numbers in parentheses are keyed to map.
†There are 92 state parks and reserves in Iowa; 23 are listed.

Iowa Fact Summary

THE PEOPLE BUILD THEIR STATE



1673—Father Jacques Marquette and Louis Joliet on their way down the Mississippi River visit Indian village near mouth of the Iowa River.

1680—Michel Aco (Accault), sent by Robert Cavelier, Sieur de La Salle, explores up Mississippi River from mouth of Illinois River past Iowa.

1682—La Salle claims Mississippi Valley for France; names it Louisiana for King Louis XIV.

1690—Nicolas Perrot builds trading post near site of Dubuque; area known as Perrot's Mines.

1762—Iowa included in area west of Mississippi River ceded by France to Spain.

1788—Julien Dubuque, first white settler in Iowa, granted permission by Indians to mine lead near present city of Dubuque.

1796—Spain makes grant of land in Iowa to Julien Dubuque; similar grants made to Louis Tesson in 1799 and to Basil Giard in 1800.

1800—Spain secretly returns Louisiana region to France.

1803—Iowa region acquired by United States from France in the Louisiana Purchase.

1804—Meriwether Lewis and William Clark leave St. Louis for exploration up Missouri Valley to West; pass through western Iowa. District of Louisiana organized, March 26; includes Iowa.

1805—Zebulon Pike explores Iowa's Mississippi bluffs.

1808—Fort Madison built as defense against Indians.

1812—Territory of Missouri organized; includes Iowa; Indians under Black Hawk battle settlers on Credit Island near site of Davenport.

1813—Indians destroy Fort Madison.

1816—Fort Armstrong established opposite site of Davenport; Col. George Davenport takes over post store; he founds Davenport, 1836.

1819—First steamboat on upper Missouri River, the *Western Engineer*, reaches Council Bluffs.

1821—Admission of Missouri as a state leaves Iowa without civil government until 1834.

1824—Trappers and soldiers married to Indian women granted land in southeast Iowa; community becomes nucleus of white settlement in Iowa.

1830—First school in region opened in Lee County. Group of miners meet at site of Dubuque (founded 1833), June 17; write compact for self-government.

1832—Defeated in Black Hawk War, Indians cede strip of land west of Mississippi River known as Black Hawk Purchase; area opened to settlement, 1833.

1834—Iowa country annexed to Michigan Territory; Des Moines and Dubuque counties organized.

1836—Iowa included in new Wisconsin Territory.

1838—Congress creates Iowa Territory, July 4; includes all land north of Missouri border between Missouri and Mississippi Rivers; temporary capital, Burlington; governor, Robert Lucas. First temperance society organized at Fort Madison.

1839—Iowa City selected as site for capital. Dispute with Missouri over boundaries causes "honey war"; governors of Missouri and Iowa call out militia; ask U. S. government to decide dispute; U. S. Supreme Court settles case in Iowa's favor, 1851.

1840—Legislature provides for free schools.

1842—Capitol at Iowa City completed and occupied. Sauk (Sac) and Fox Indians cede their remaining lands in Iowa; to be vacated by 1845.

1843—Missionary "Iowa band" arrives to found churches and colleges.

1844—Constitution for proposed statehood framed and twice rejected by popular vote in dispute over projected state's boundaries.

1846—New constitution framed and adopted; Iowa admitted to the Union, with present boundaries, December 28; is 29th state. Mormons, driven from Illinois, camp in Iowa en route west. Indians in Des Moines region move to Kansas.

1847—University of Iowa established; opens at Iowa City, 1855.

1848—First telegraph line links Burlington and Muscatine.

1849—Council Bluffs becomes outfitting point for some gold rush "forty-niners."

1853—Iowa State Agricultural Society organized. Mississippi and Missouri Railroad begins construction at Davenport, September 1; first locomotive ferried across river at Davenport, 1854; road (now part of Chicago, Rock Island line) opened between Davenport and Muscatine, 1855; completed to Iowa City, Jan. 1, 1856; train crosses Davenport bridge, first across the Mississippi River, April 14; railroad crosses state, 1867.

1854—Josiah Grinnell, New York minister, settles in Iowa, founding town of Grinnell.

1855—German religious communal colony, settles in Iowa County; later incorporated as Amana Society.

1857—Sioux Indians attack settlers in Spirit Lake Massacre. Present state constitution adopted, August 3. Capital moved to Des Moines.

1858—State College of Agriculture established; opens at Ames, 1868. School-district system established.

1862—Sioux uprising is last Indian conflict in state.

1870—Manufacturing of dairy products begun in Delaware County.

1877—William H. Voss invents a washing machine at Davenport; founds one of state's major industries.

1878—State railway commission established.

1880—Chinch bugs ravage wheat fields; Iowa farmers turn to corn growing.

1884—New State Capitol dedicated. Prohibition adopted; act modified, 1894; prohibition readopted, 1915.

1897—Child labor law adopted.

1901—Charles H. Parr and Charles W. Hart of Charles City build first agricultural tractor.

1909—State Board of Education created.

1914—Keokuk Dam completed. Legislature establishes three-man state highway commission.

1922—Henry A. Wallace, born Adair Co., and Simon Cassady develop high-yield hybrid corn. Wallace later becomes vice-president of U. S., 1941–45.

1923—State Department of Agriculture established.

1926—Constitutional amendment permits women to hold seats in General Assembly.

1929—Herbert Hoover, born at West Branch, becomes 31st president of U. S.; is first president born west of Mississippi River.

1932—Farm Holiday Association, organized 1931, forces halting of foreclosures of farm mortgages.

1933—State Conservation Commission begins 25-year conservation program.

1934—Iowa repeals state prohibition act.

1946—Iowa celebrates its centennial of statehood.

1949—Commission to plan reorganization of state government established.

1952—Record floods of Missouri and Mississippi rivers hit cities and farms of western and eastern Iowa.

IOWA

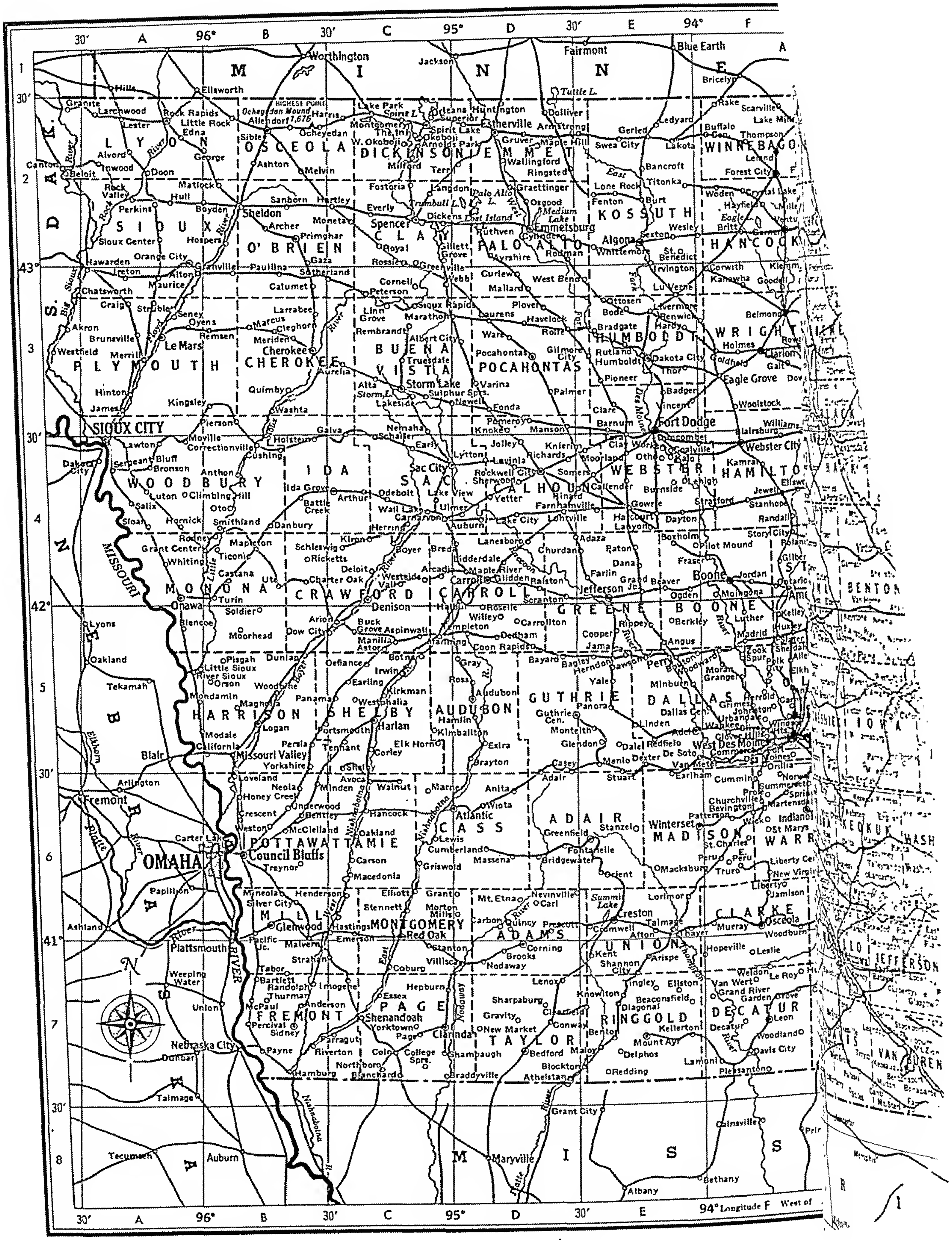
COUNTIES

Adair	12,292	E 6
Adams	8,753	D 6
Allamakee	16,351	L 2
Appanoose	19,683	H 7
Audubon	11,570	D 5
Benton	22,656	J 4
Black Hawk	100,448	J 4
Boone	28,139	F 5
Bremer	18,884	J 3
Buchanan	21,927	K 4
Buena Vista	21,113	C 3
Butler	17,394	H 3
Calhoun	16,925	D 4
Carroll	23,065	D 4
Cass	18,532	D 6
Cedar	16,910	L 5
Cerro Gordo	46,053	G 2
Cherokee	19,052	B 3
Chickasaw	15,228	J 2
Clarke	9,369	F 6
Clay	18,103	C 2
Clayton	22,522	L 3
Clinton	49,664	M 5
Crawford	19,741	C 4
Dallas	23,661	E 5
Davis	9,959	J 7
Decatur	12,601	F 7
Delaware	17,734	L 4
Des Moines	42,056	L 7
Dickinson	12,756	C 2
Dubuque	71,337	M 4
Emmet	14,102	D 2
Fayette	28,294	K 3
Floyd	21,505	H 2
Franklin	16,268	G 3
Fremont	12,323	B 7
Greene	15,544	E 5
Grundy	13,722	H 4
Guthrie	15,197	D 5
Hamilton	19,660	F 4
Hancock	15,077	F 2
Hardin	22,218	G 4
Harrison	19,560	B 5
Henry	18,708	K 6
Howard	13,105	J 2
Humboldt	13,117	E 3
Ida	10,697	C 4
Iowa	15,835	J 5
Jackson	18,622	M 4
Jasper	32,305	G 5
Jefferson	15,696	K 6
Johnson	45,756	K 5
Jones	19,401	L 4
Keokuk	16,797	J 6
Kossuth	26,241	E 2
Lee	43,102	L 7
Linn	104,274	K 4
Louisa	11,101	L 6
Lucas	12,069	G 6
Lyon	14,697	A 2
Madison	13,131	E 6
Mahaska	24,672	H 6
Marion	25,930	G 6
Marshall	35,611	G 4
Mills	14,064	B 6
Mitchell	13,945	H 2
Monona	16,303	B 4
Monroe	11,814	H 7
Montgomery	15,685	C 6
Muscatine	32,148	L 5
O'Brien	18,970	B 2
Osceola	10,181	B 2
Page	23,921	C 7
Palo Alto	15,891	D 2
Plymouth	23,252	A 3
Pocahontas	15,496	D 3
Polk	226,010	F 5
Pottawattamie	69,682	B 6
Poweshiek	19,344	H 5
Ringgold	9,528	E 7
Sac	17,518	C 4
Scott	100,698	M 5
Shelby	15,942	C 5
Sioux	26,381	A 2
Story	44,294	G 4
Tama	21,688	H 4
Taylor	12,420	D 7
Union	15,651	E 7
Van Buren	11,007	K 7
Wapello	47,397	J 6
Warren	17,758	F 6
Washington	19,557	K 6
Wayne	11,737	G 7
Webster	44,241	E 4
Winnebago	13,450	F 2
Winneshiek	21,639	K 2
Woodbury	103,917	B 4
Worth	11,068	G 2
Wright	19,652	F 3

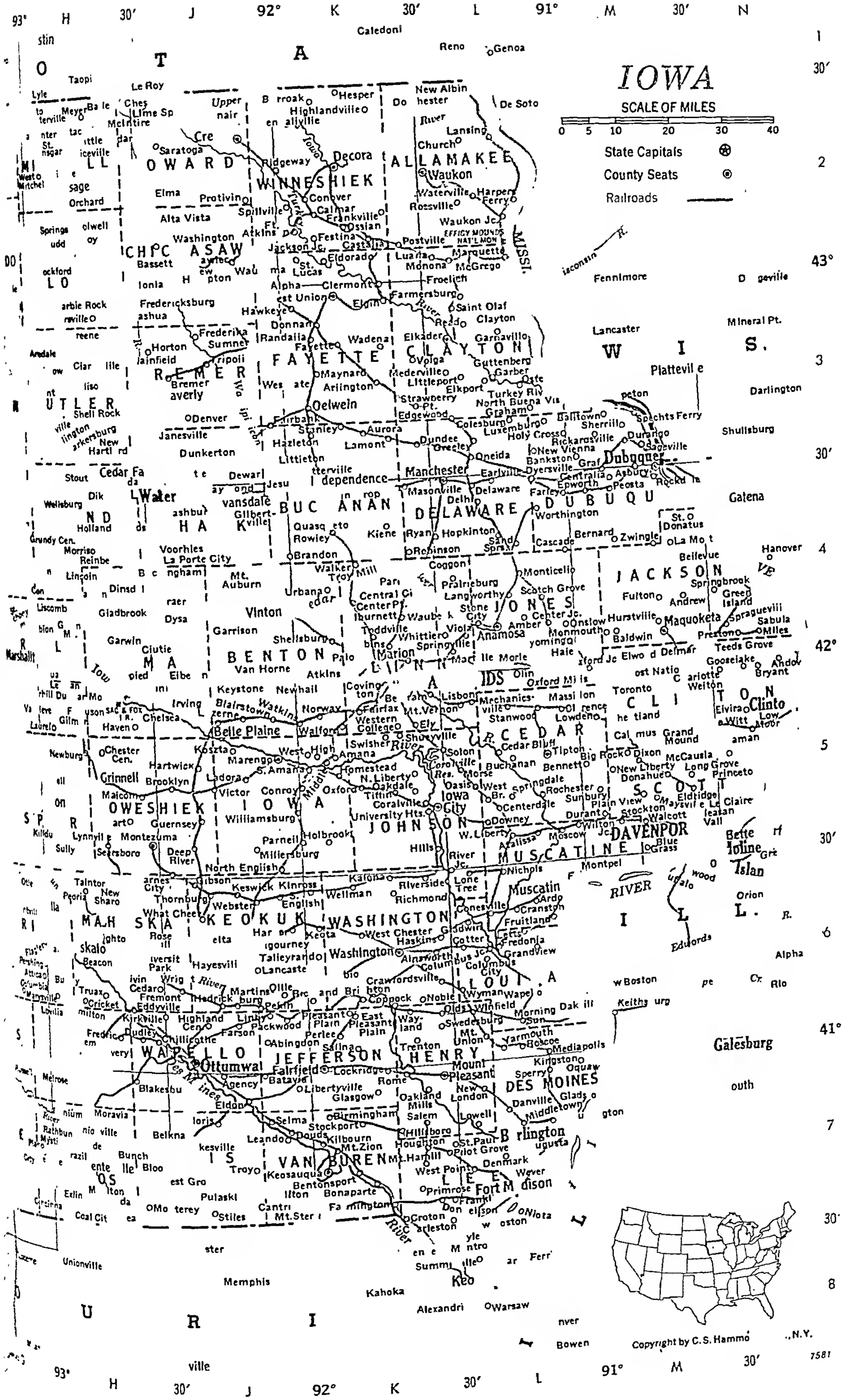
CITIES AND TOWNS

Abingdon	70	J 6
Ackley	1,608	G 3
Ackworth	95	G 6
Adair	827	D 6
Adaza	51	E 4
Adel	1,799	E 5
Afton	936	E 6
Agency	524	J 7
Ainsworth	396	K 6
Akron	1,251	A 3
Albert City	736	C 3
Albia	4,838	H 6
Albion	492	H 4
Alburnett	254	K 4
Alden	829	G 4
Alexander	278	G 3
Algona	5,415	E 2
Alleman	108	F 5
Allendorf	55	B 2
Allerton	761	G 7
Allison	771	H 3
Alpha	122	K 3
Alta	1,348	C 3
Alta Vista	312	J 2
Alton	1,038	A 3
Altoona	763	G 5
Alvord	263	A 2
Amana		K 5
Amber	115	L 4
Ames	22,898	F 4
Anamosa	3,910	L 4
Anderson	120	B 7
Andover	80	N 5
Andrew	280	M 4
Angus	150	E 5
Anita	1,112	D 6
Ankeny	1,229	F 5
Anthon	770	B 4
Aplington	702	H 3
Arcadia	425	C 4
Archer	167	B 2
Ardon	20	L 6
Aredale	204	H 3
Argyle	85	K 7
Arion	220	B 5
Arispe	110	E 7
Arlington	661	K 3
Armstrong	943	D 2
Arnolds Park	1,078	C 2
Arthur	243	C 4
Asbury	52	M 4
Ashton	588	B 2
Aspinwall	107	C 5
Astor		C 5
Atalissa	204	L 5
Athelstan	115	D 7
Atkins	387	K 4
Atlantic	6,480	D 6
Attica		G 6
Auburn	350	D 4
Audubon	2,808	D 5
Augusta	50	L 7
Aurelia	807	C 3
Aurora	225	K 3
Austinville	130	H 3
Avery	175	H 6
Avoca	1,595	C 6
Ayrshire	334	D 2
Badger	301	E 3
Bagley	392	E 5
Bailey	25	H 2
Baldwin	208	M 4
Balltown	49	M 3
Bancroft	901	E 2
Bankston	40	L 3
Barnes City	326	H 6
Barnum	193	E 3
Bartlett	88	B 7
Bassett	125	J 2
Batavia	524	J 7
Battle Creek	873	B 4
Baxter	618	G 5
Bayard	634	D 5
Beacon	371	H 6
Beaconsfield	104	E 7
Beaman	191	H 4
Beaver	114	E 4
Bedford	2,000	D 7
Beech	106	G 6
Belknap	80	J 7
Bello Plaine	3,056	J 5
Bellevue	1,932	M 4
Belmond	2,169	F 3
Beloit	90	A 2
Bennett	357	L 5
Bentley	50	B 6
Benton	128	E 7
Bontonsport	60	K 7
Berkley	71	E 5
Bernard	149	M 4
Bertram	128	K 5
Berwick	113	G 5
Bethlehem	52	G 7
Bettendorf	5,132	N 5
Bevington	48	F 6
Big Rock	106	M 5
Birmingham	643	K 7
Blairsburg	257	F 4
Blairstown	523	J 5
Blakesburg	401	H 7
Blanchard	214	C 7
Blencoe	328	A 5
Blockton	407	D 7
Bloomfield	2,688	J 7
Blue Grass	337	M 5
Bode	492	E 3
Bonair	80	J 2
Bonaparte	642	K 7
Bondurant	328	G 5
Boone	12,164	F 4
Botna	54	C 5
Bouton	159	E 5
Boxholm	304	E 4
Boyden	541	B 2
Boyer	70	C 4
Braddyville	249	D 7
Bradford		G 3
Bradgate	188	E 3
Brandon	319	K 4
Brayton	239	D 5
Brazil		H 7
Breda	506	C 4
Bremer	80	J 3
Bridgewater	296	D 6
Brighton	705	K 6
Bristow	313	H 3
Britt	1,908	F 2
Bronson	295	A 4
Brooklyn	1,323	J 5
Brooks	180	D 7
Brunsville	112	A 3
Bryant	45	N 5
Buchanan	36	L 5
Buck Grove	67	C 5
Buckeye	192	G 4
Buckingham	68	J 4
Buffalo	695	M 6
Buffalo Ctr.	1,087	F 2
Bunch	103	H 7
Burchinal	75	G 2
Burdette	18	G 3
Burlington	30,613	L 7
Burnside	105	E 4
Burroak	250	K 2
Burt	572	E 2
Bussey	633	H 6
Calamus	381	M 5
California	125	B 5
Callender	387	E 4
Calmar	937	K 2
Calumet	250	B 3
Camanche	1,212	N 5
Cambria	125	G 7
Cambridge	573	G 5
Cantril	353	J 7
Carbon	282	D 6
Carl	40	D 6
Carlisle	903	G 6
Carnarvon	115	C 4
Carney	75	F 5
Carpenter	165	H 2
Carroll	6,231	D 4
Carrollton	17	D 5
Carson	596	C 6
Carter Lake	1,183	B 6
Cartersville	25	G 2
Cascade	1,299	L 4
Casey	703	D 5
Castalia	221	K 2
Castana	265	B 4
Castle Hill	425	J 3
Cedar	110	H 6
Cedar Bluff	75	L 5
Cedar Falls	14,334	H 3
Cedar Heights		H 3
Cedar Rapids	72,296	K 5
Center Jct.	153	L 4
Center Point	987	K 4
Centerdale	34	L 5
Centerville	7,625	H 7
Central City	965	K 4
Central Hts.	766	*G 2
Centralia	78	M 4
Chapin	200	G 3
Chariton	5,320	G 6
Charles City	10,309	H 2
Charleston	30	K 7
Charlotte	427	M 5
Charter Oak	710	C 4
Chatsworth	102	A 3
Chelsea	482	J 5
Cherokee	7,705	B 3
Chester	226	J 2
Chester Ctr.		H 5
Chillicothe	196	J 6
Church	40	L 2
Churchville	25	F 6
Churdan	593	D 4
Cincinnati	703	G 7
Clare	179	E 3
Clarence	791	M 5
Clarinda	5,086	C 7
Clarion	3,150	F 3
Clarksville	1,210	H 3
Clay Works	175	E 4
Clayton	136	L 3
Clear Lake	4,977	G 2
Clearfield	547	D 7
Cleghorn	246	B 3
Clemons	202	G 4
Clermont	625	K 3
Cleves	50	G 4
Climbing Hill	140	B 4
Clinton	30,379	N 5
Clio	162	G 7
Clive	250	F 5
Clover Hills	408	F 5
Clutier	302	J 4
Coal City		H 7
Coalville	350	E 4
Coburg	83	C 7
Coggon	604	L 4
Coin	407	C 7
Colesburg	326	L 3
Colfax	2,279	G 5
College Sprs.	368	C 7
Collins	432	G 5
Colo	538	G 4
Columbia	110	G 6
Columbus City	350	L 6
Columbus Jct.	1,123	L 6
Colwell	122	H 2
Commerce	152	F 5
Conesville	252	L 6
Confidence	65	G 7
Conover		K 2
Conrad	649	H 4
Conroy	200	J 5
Conway	168	D 7
Coon Rapids	1,676	D 5
Cooper	99	E 5
Coppock	81	K 6
Coralville	977	K 5
Cordova	15	G 6
Corley	60	C 5
Cornell		C 3
Corning	2,104	D 7
Correctionville	992	B 4
Corwith	480	F 3
Corydon	1,870	G 7
Cotter	49	L 6
Coulter	271	G 3
Council Bluffs	45,429	B 6
Covington	82	K 5
Craig	142	A 3
Cranston		L 6
Crawfordsville	286	K 6
Crescent		B 6
Cresco	3,638	J 2
Creston	8,317	E 6
Cricket		H 6
Cromwell	147	E 6
Croton	55	K 7
Crystal Lake	286	F 2
Cumberland	493	D 6
Cumming	131	F 6
Curlew	151	D 3
Cushing	248	B 4
Cylinder	143	D 2
Dakota City	637	E 3
Dale	30	E 5
Dallas	421	G 6
Dallas Ctr.	944	E 5
Dana	184	E 4
Danbury	601	B 4
Danville	450	L 7
Davenport	74,549	M 5
Davis City	432	F 7
Dawson	286	E 5
Dayton	793	E 4
De Soto	280	E 5
De Witt	2,644	N 5
Dean	45	H 7
Decatur	196	F 7
Decorah	6,060	K 2
Dedham	360	D 5
Deep River	379	J 5
Defiance	368	C 5
Delaware	192	L 4
Delhi	383	L 4
Delmar	415	M 4
Deloit	235	C 4
Delphos	74	E 7
Delta	562	J 6
Denison	4,554	C 4
Denmark	300	L 7
Denver	635	J 3
Derby	194	G 7
DES MOINES	177,965	F 5
Dewar	150	J 3
Dexter	643	E 5
Diagonal	472	E 7
Dickens	311	C 2
Dike	517	H 4
Dinsdale	80	H 4
Dixon	208	M 5
Dolliver	130	D 2
Donahue	105	M 5
Donnan	36	K 3
Donnellson	589	K 7
Doon	517	A 2
Dorchester	120	L 2
Douds	425	K 7
Dougherty	212	G 3
Dow City	524	B 5
Downey	126	L 5
Dows	948	F 3
Drakesville	222	J 7
Dubuque	49,671	M 3
Dudley	54	H 6
Dumont	718	H 3
Dunbar	80	H 5
Duncombe	378	E 4
Dundee	176	L 3
Dunkerton	409	J 3
Dunlap	1,409	B 5
Durango	71	M 3
Durant	1,075	M 5
Dyersville	2,416	L 3
Dysart	1,089	J 4
Eagle Grove	4,176	F 3
Earlham	771	E 6
Earling	341	C 5
Earlville	661	L 4
Early	742	C 4
E. Peru	204	F 6
E. Pleasant Plain		K 6
Eddyville	941	H 6
Edgewood	696	L 3
Edna	80	A 2
Elberon	225	J 4
Eldon	1,457	J 7

*No room on map for name.



30′ A 96° B 30′ C 95° D 30′ E 94° F
M I N N E S O T A
Worthington
Jackson
Fairmont
Blue Earth
S. DAK.
NEBRASKA
MISSOURI
M I S S O U R I
LYON
OSCEOLA
DICKINSON
EMMET
KOSSUTH
WINNEBAGO
HANCOCK
SIOUX
O'BRIEN
CLAY
PALO ALTO
PLYMOUTH
CHEROKEE
BUENA VISTA
POCAHONTAS
HUMBOLDT
WRIGHT
WOODBURY
IDA
SAC
CALHOUN
WEBSTER
HAMILTON
MONONA
CRAWFORD
CARROLL
GREENE
BOONE
HARRISON
SHELBY
AUDUBON
GUTHRIE
DALLAS
POLK
POTTAWATTAMIE
CASS
ADAIR
MADISON
WARREN
MILLS
MONTGOMERY
ADAMS
UNION
CLARKE
FREMONT
PAGE
TAYLOR
RINGGOLD
DECATUR
SIOUX CITY
OMAHA
Council Bluffs
Fort Dodge
Des Moines
Le Mars
Sheldon
Spencer
Storm Lake
Cherokee
Denison
Carroll
Harlan
Atlantic
Red Oak
Shenandoah
Clarinda
Creston
Osceola
Boone
Jefferson
Webster City
Algona
Emmetsburg
Estherville
Spirit Lake
Clarion
Eagle Grove
Winterset
Missouri Valley
Onawa
Glenwood
Maryville
Nebraska City
Plattsmouth
Fremont
Blair
Tekamah
Bethany
Albany
Grant City
Tecumseh
Auburn
Missouri River
Des Moines River
Boone River
Raccoon River
Nishnabotna River
Nodaway River
Platte River
Big Sioux River
Rock River
Floyd River
Little Sioux River
Boyer River
Ocheyedan Mound Highest Point 1,676
Okoboji L.
Storm L.
BENTON
IOWA
KEOKUK
WASH
JEFFERSON
VAN BUREN
30′ A 96° B 30′ C 95° D 30′ E 94° Longitude F West of


IOWA
SCALE OF MILES
0 5 10 20 30 40
State Capitals
County Seats
Railroads
WINNESHIEK
ALLAMAKEE
FAYETTE
CLAYTON
BUCHANAN
DELAWARE
DUBUQUE
JACKSON
BENTON
JONES
CEDAR
CLINTON
JOHNSON
IOWA
MUSCATINE
SCOTT
DAVENPOR
KEOKUK
WASHINGTON
LOUISA
JEFFERSON
HENRY
DES MOINES
VAN BUREN
LEE
WAPELLO
WISCONSIN
ILLINOIS
MISSOURI
Dubuque
Cedar Rapids
Iowa City
Ottumwa
Burlington
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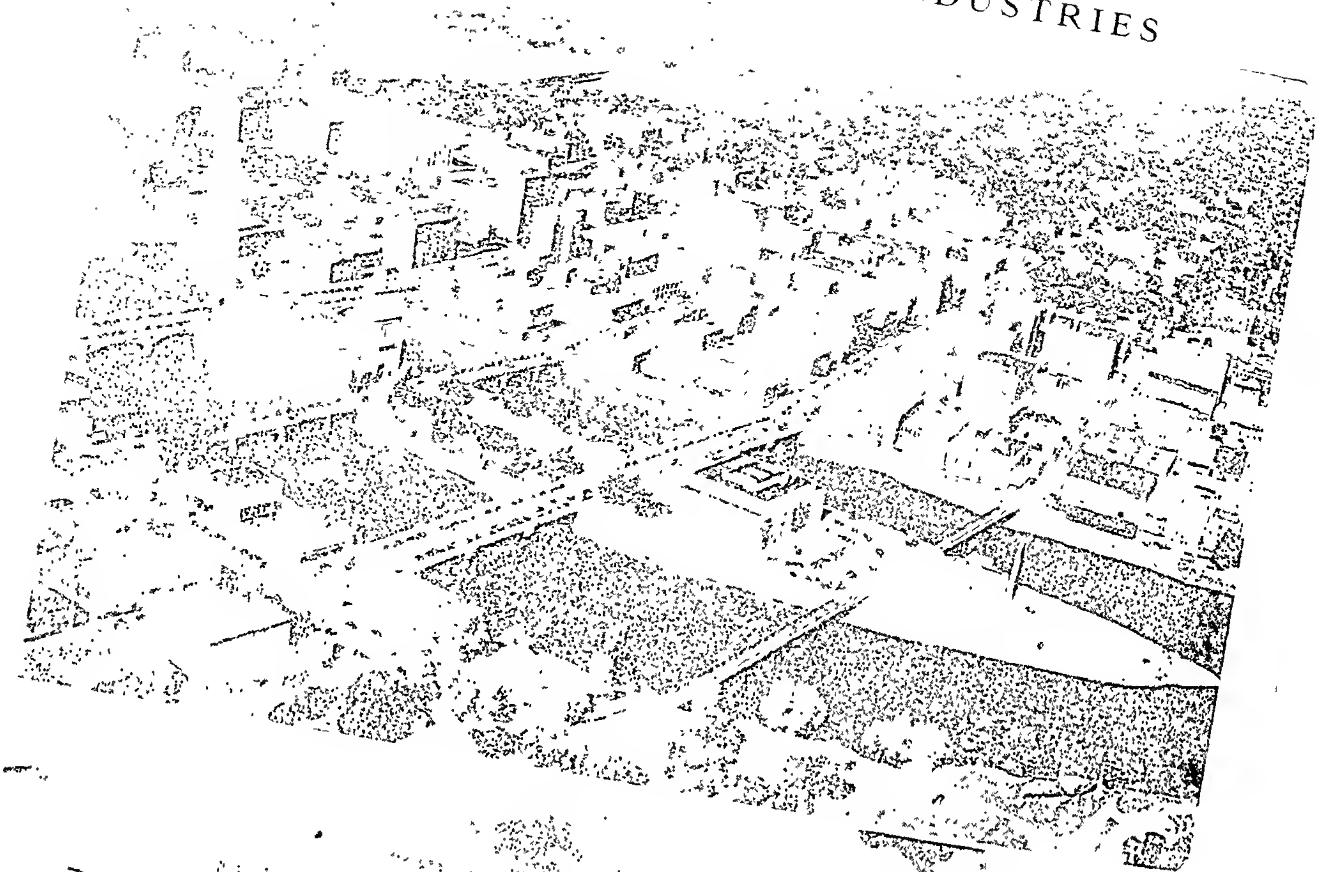
7581

Eldora	3,107	G 4
Eldorado	100	K 2
Eldridge	376	M 5
Elgin	642	K 3
Elk Horn	566	C 5
Elkader	1,584	L 3
Elkhart	222	F 5
Elkport	99	L 3
Elliott	482	C 6
Ellston	158	E 7
Ellsworth	439	F 4
Elma	731	J 2
Elvira	210	N 5
Elwood	125	M 4
Ely	155	K 5
Emerson	556	C 6
Emmetsburg	3,760	D 2
Epworth	536	M 4
Essex	763	C 7
Estherville	6,719	D 2
Evansdale	3,571	J 4
Everly	547	C 2
Ewart	34	H 5
Exira	1,129	D 5
Exline	342	H 7
Fairbank	653	K 3
Fairfax	335	K 5
Fairfield	7,299	J 6
Fairport	150	M 6
Farley	745	L 4
Farlin	85	E 4
Farmersburg	263	L 3
Farmington	899	K 7
Farnhamville	399	D 4
Farragut	495	C 7
Farrar	64	G 5
Farson	100	J 6
Faulkner	50	G 3
Fayette	1,469	K 3
Fenton	446	E 2
Ferguson	178	H 5
Fernald	100	G 4
Fertile	397	G 2
Festina	160	K 2
Flagler	55	G 6
Floris	215	J 7
Floyd	440	H 2
Fonda	1,120	D 3
Fontanello	812	E 6
Forest City	2,766	F 2
Ft. Atkinson	273	J 2
Ft. Des Moines	10,000	F 5
Fort Dodge	25,115	E 3
Ft. Madison	14,954	L 7
Fostoria	147	C 2
Franklin	146	L 7
Frankville	169	K 2
Fraser	219	E 4
Fredericksburg	701	J 3
Frederika	210	J 3
Fredonia	133	L 6
Fredric	28	H 6
Fremont	471	H 6
Froelich	65	L 2
Fruitland	150	L 6
Fulton		M 4
Galt	117	F 3
Galva	492	C 3
Garber	153	L 3
Garden City	150	G 4
Garden Grove	417	F 7
Garnavillo	581	L 3
Garner	1,696	F 2
Garrison	457	J 4
Garwin	518	H 4
Gaza	85	B 2
Geneva	242	G 3
George	1,210	B 2
Gerled	41	E 2
Gibson	101	J 6
Gifford	118	G 4
Gilbert	297	F 4
Gilbertville	399	J 4
Gillett Grove	150	C 2
Gilman	508	H 5
Gilmore City	746	D 3
Givin	75	H 6
Gladbrook	862	H 4
Gladwin	50	L 6
Glasgow	85	K 7
Glendon	44	E 5
Glenwood	4,664	B 6
Glidden	996	D 4
Goldfield	665	F 3
Goodell	242	F 3
Gooselake	148	N 5
Gowrie	1,052	E 4
Graettinger	1,016	D 2
Graf	44	M 3
Grafton	278	G 2
Graham		L 3
Grand Jct.	1,036	E 4
Grand Mound	526	M 5
Grand River	350	F 7
Grandview	311	L 6
Granger	300	F 5
Granite	15	A 2
Grant	237	C 6
Grant Center		A 4
Granville	350	B 3
Gravity	369	D 7
Gray	183	D 5
Greeley	360	L 3
Green Island	120	N 4
Green Mountain	199	H 4
Greene	1,347	H 3
Greenfield	2,102	D 6
Greenville	173	C 3
Grimes	582	F 5
Grinnell	6,828	H 5
Griswold	1,149	C 6
Grundy Ctr.	2,135	H 4
Gruver	135	D 2
Guernsey	113	J 5
Guthrie Center	2,042	D 5
Guttenberg	1,912	L 3
Halbur	235	D 4
Hale	75	L 4
Hamburg	2,086	B 7
Hamilton	245	H 6
Hamlin	200	D 5
Hampton	4,432	G 3
Hancock	264	C 6
Hanlontown	257	G 2
Hansell	190	G 3
Harcourt	303	E 4
Hardy	139	E 3
Harlan	3,915	C 5
Harper	182	J 6
Harpers Ferry	252	L 2
Harris	319	C 2
Hartford	221	G 6
Hartley	1,611	C 2
Hartwick	107	J 5
Harvard		G 7
Harvey	346	H 6
Haskins	65	K 6
Hastings	308	C 6
Havelock	307	D 3
Haven	50	H 5
Haverhill		H 5
Hawarden	2,625	A 2
Hawkeye	511	J 3
Haycsville	137	J 6
Hayfield	200	F 2
Hazleton	550	K 3
Hedrick	733	J 6
Henderson	208	B 6
Hepburn	64	C 7
Herndon	100	E 5
Herring	15	C 4
Herrold	45	F 5
Hesper		K 2
High	130	K 5
Highland Center	85	J 6
Highlandville	57	K 2
Hills	248	K 5
Hillsboro	253	K 7
Hinton	345	A 3
Hiteman	250	H 6
Holbrook	29	K 5
Holland	221	H 4
Holmes	65	F 3
Holstein	1,336	B 4
Holy Cross	139	L 3
Homestead	150	K 5
Honey Creek	62	B 6
Hopeville		F 7
Hopkinton	731	L 4
Hornick	310	A 4
Horton	66	J 3
Hospers	604	B 2
Houghton		K 7
Hubbard	836	G 4
Hudson	613	H 4
Hull	1,127	A 2
Humboldt	3,219	E 3
Humeston	750	G 7
Huntington	39	D 2
Hurstville	83	M 4
Huxley	422	F 5
Iconium	75	H 7
Ida Grove	2,202	B 4
Imogene	274	C 7
Independence	4,865	K 4
Indianola	5,145	F 6
Inwood	644	A 2
Ionia	301	J 2
Iowa City	27,212	L 5
Iowa Falls	4,900	G 3
Ira	103	G 5
Ireton	573	A 3
Irving	78	J 5
Irvington	110	E 3
Irwin	381	C 5
Jackson Jct.	107	K 2
Jamaica	303	E 5
James	36	A 3
Jamison	40	F 6
Janesville	445	J 3
Jefferson	4,326	E 4
Jerome	130	G 7
Jesup	1,158	J 4
Jewell	973	F 4
Johnston	750	F 5
Joice	244	G 2
Jolley	195	D 4
Jordan	50	F 4
Kalo	150	E 4
Kalona	947	K 6
Kamrar	261	F 4
Kanawha	747	F 3
Kellerton	483	E 7
Kelley	244	F 5
Kellogg	670	H 5
Kendallville		K 2
Kensett	424	G 2
Kent	169	E 7
Keokuk	16,144	L 8
Keosauqua	1,101	J 7
Keota	1,145	K 6
Kesley	125	H 3
Keswick	276	J 6
Keystone	438	J 5
Kiene	11	K 4
Kilbourn	73	K 7
Killduff	145	H 5
Kimballton	428	D 5
Kingsley	1,098	A 3
Kingston	150	L 7
Kinross	105	J 6
Kirkman	131	C 5
Kirkville	213	H 6
Kiron	255	C 4
Klemme	555	F 3
Knierim	133	D 4
Knoke	49	D 3
Knowlton	60	E 7
Knoxville	7,625	G 6
Koszta	45	J 5
La Moille	151	G 4
La Motte	280	M 4
La Porte City	1,770	J 4
Lacona	430	G 6
Ladora	273	J 5
Lake City	2,308	D 4
Lake Mills	1,560	F 2
Lake Park	924	C 2
Lake View	1,158	C 4
Lakeside	219	C 3
Lakota	443	E 2
Lamoni	2,196	F 7
Lamont	574	K 3
Lancaster	25	J 6
Lanesboro	280	D 4
Langdon	60	C 2
Langworthy	64	L 4
Lansing	1,536	L 2
Lanyon	120	E 4
Larchwood	415	A 2
Larrabee	158	B 3
Latimer	434	G 3
Laurel	257	H 5
Laurens	1,556	D 3
Lavinia	65	D 4
Lawler	539	J 2
Lawn Hill	40	G 4
Lawton	254	A 4
Le Claire	1,124	N 5
Le Grand	393	H 5
Le Mars	5,844	A 3
Le Roy	91	F 7
Leando		J 7
Ledyard	327	E 2
Lehigh	881	E 4
Leighton	118	H 6
Leland	209	F 2
Lenox	1,171	D 7
Leon	2,139	F 7
Leslie	25	F 7
Lester	217	A 2
Letts	404	L 6
Lewis	511	C 6
Liberty	56	F 6
Liberty Center	110	F 6
Libertyville	311	K 7
Lidderdale	180	D 4
Lime Springs	551	J 2
Linby	50	J 6
Lincoln	194	H 4
Linden	290	E 5
Lineville	482	G 7
Linn Grove	320	C 3
Linwood	100	M 6
Lisbon	952	L 5
Liscomb	278	H 4
Little Cedar	80	H 2
Little Rock	533	B 2
Little Sioux	349	B 5
Littleport	139	L 3
Littleton	75	K 3
Livermore	615	E 3
Lockridge	233	K 7
Logan	1,550	B 5
Lohrville	698	D 4
Lone Rock	188	E 2
Lone Tree	639	L 6
Long Grove	156	M 5
Lorimor	505	E 6
Lost Nation	557	M 5
Loveland	55	B 6
Lovilia	619	H 6
Low Moor	279	N 5
Lowden	642	M 5
Lowell	85	L 7
Lu Verne	553	E 3
Luana	220	K 2
Lucas	420	G 6
Luther	131	F 5
Luton	154	A 4
Luxemburg	120	L 3
Luzerne	186	J 5
Lynnville	406	H 5
Lytton	373	D 4
Macedonia	298	C 6
Macksburg	220	E 6
Madrid	1,829	F 5
Magnolia	207	B 5
Malcom	406	H 5
Mallard	399	D 3
Maloy	90	E 7
Malvern	1,263	B 7
Manchester	3,987	L 3
Manilla	1,035	C 5
Manly	1,473	G 2
Manning	1,801	C 5
Manson	1,622	D 3
Maple Hill	60	D 2
Maple River	120	D 4
Mapleton	1,857	B 4
Maquoketa	4,307	M 4
Marathon	565	C 3
Marble Rock	470	H 3
Marcus	1,263	B 3
Marengo	2,151	J 5
Marion	5,916	K 4
Marne	214	C 6
Marquette	641	L 2
Marshalltown	19,821	G 4
Martelle	228	L 4
Martensdale	161	F 6
Martinsburg	219	J 6
Marysville	165	G 6
Mason City	27,980	G 2
Masonville	133	K 4
Massena	459	D 6
Massillon	90	L 5
Matlock	104	A 2
Maurice	256	A 3
Maxwell	802	G 5
Maynard	455	K 3
Maysville	70	M 5
McCallsburg	290	G 4
McCausland	150	M 5
McClelland	159	B 6
McGregor	1,138	L 2
McIntire	300	H 2
McPaul	35	B 7
Mechanicsville	850	L 5
Mederville		K 3
Mediapolis	834	L 6
Melbourne	510	G 5
Melcher	898	G 6
Melrose	310	G 7
Meltonville		G 2
Melvin	325	B 2
Menlo	421	E 5
Meriden	164	B 3
Merrill	605	A 3
Meservey	297	G 3
Meyer		H 2
Middle		K 5
Middletown	229	L 7
Miles	344	N 4
Milford	1,375	C 2
Miller	75	F 2
Millersburg	200	J 5
Millerton	140	G 7
Milo	525	G 6
Milton	719	J 7
Minburn	353	E 5
Minden	328	C 6
Mineola	145	B 6
Mingo	227	G 5
Missouri Valley	3,546	B 5
Mitchell	168	H 2
Mitchellville	906	G 5
Modale	283	B 5
Moingona	150	F 4
Mondamin	489	B 5
Moneta	89	C 2
Monmouth	198	M 4
Monona	1,346	L 2
Monroe	1,108	G 5
Monteith		E 5
Monterey	35	H 7
Montezuma	1,460	H 5
Montgomery	150	C 2
Monticello	2,888	L 4
Montour	380	H 5
Montpelier	200	M 6
Montrose	643	L 7
Mooar	235	L 8
Moorhead	392	B 5
Moorland	248	E 4
Moran	150	F 5
Moravia	652	H 7
Morley	157	L 4
Morning Sun	939	L 6
Morrison	169	H 4
Morse		L 5
Morton Mills	70	C 6
Moscow	195	L 5
Moulton	985	H 7
Mt. Auburn	216	J 4
Mt. Ayr	1,793	E 7
Mt. Etna	90	D 6
Mt. Hamill	44	K 7
Mt. Pleasant	5,843	L 7
Mt. Sterling	144	J 7
Mt. Union	167	L 6
Mt. Vernon	2,320	K 5
Mt. Zion	50	K 7
Moville	964	A 4
Murray	767	F 6
Muscatine	19,041	L 6
Mystic	1,233	H 7
Nashua	1,609	J 3
Nemaha	184	C 3
Neola	839	B 6
Nevada	3,763	G 5
Nevinville	75	D 6
New Albin	568	L 2
New Boston	116	L 7
New Hampton	3,323	J 2
New Hartford	584	H 3
New Liberty	126	M 5
New London	1,510	L 7
New Market	573	D 7

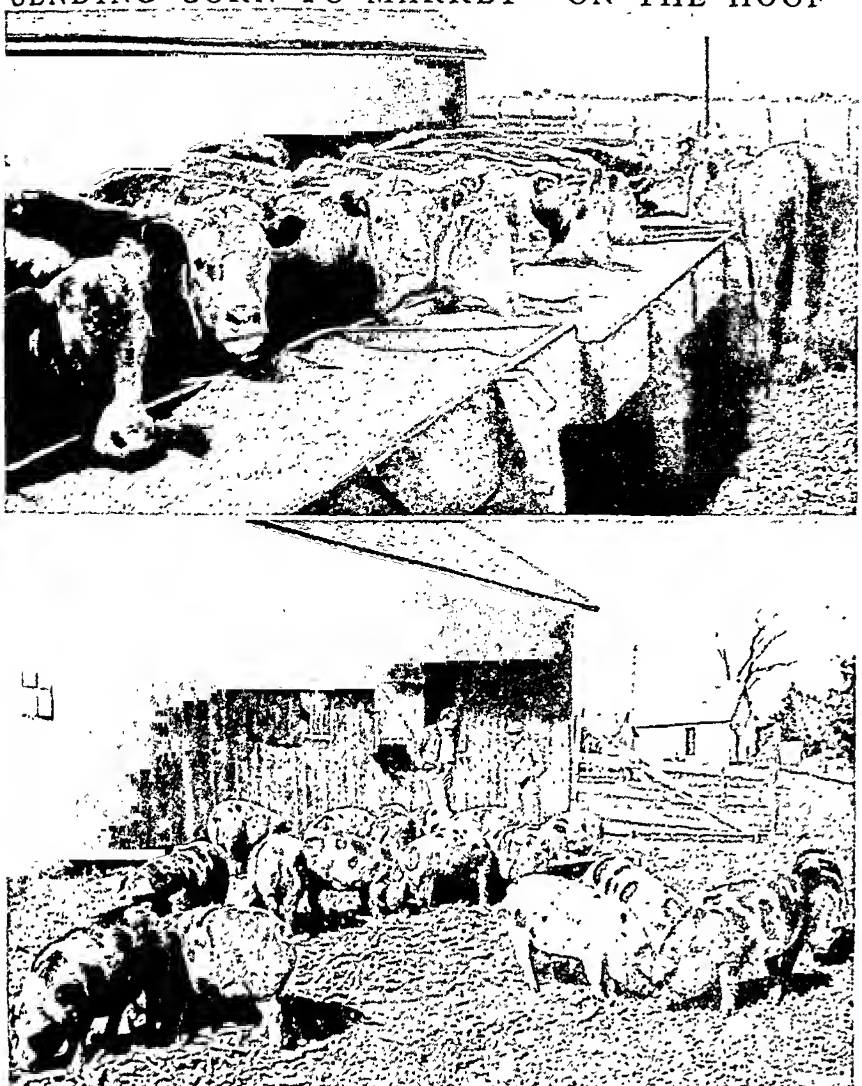
New Providence	212	G 4
New Sharon	1,089	H 6
New Vienna	204	L 3
New Virginia	342	F 6
Newbern	24	G 6
Newburg	105	H 5
Newell	884	D 3
Newhall	366	K 5
Newton	11,723	H 5
Nichols	348	L 6
Noble	34	K 6
Nodaway	233	D 7
Nora Springs	1,257	H 2
N. Buena Vista	148	L 3
N. English	853	J 5
N. Liberty	309	K 5
N. Washington	159	J 2
Northboro	167	C 7
Northwood	1,767	G 2
Norwalk	435	F 6
Norway	441	K 5
Numa	248	G 7
Oakdale	650	K 5
Oakland	1,296	C 6
Oakland Mills	37	K 7
Oakley	25	G 6
Oakville	360	L 6
Oasis	27	L 5
Ocheyedan	700	B 2
Odebolt	1,279	C 4
Oelwein	7,858	K 3
Ogden	1,486	E 4
Okoboji	336	C 2
Old Town	40	*C 2
Olds	187	K 6
Olin	626	L 5
Ollie	298	J 6
Onawa	3,498	A 4
Oneida	75	L 3
Onslow	244	M 4
Ontario	140	F 4
Oran	110	J 3
Orange City	2,166	A 2
Orchard	114	H 2
Orient	427	E 6
Orillia	25	F 6
Orleans	317	C 2
Orson	21	B 5
Osage	3,436	H 2
Osceola	3,422	F 6
Osgood	50	D 2
Oskaloosa	11,124	H 6
Ossian	804	K 2
Osterdock	51	L 3
Otho	403	E 4
Otley	177	G 6
Oto	302	B 4
Otranto	75	H 2
Otterville		K 3
Ottosen	127	E 3
Ottumwa	33,631	J 6
Owasa	100	G 4
Oxford	543	K 5
Oxford Jct.	663	M 4
Oxford Mills	103	L 5
Oyens	35	A 3
Pacific Jct.	550	B 6
Packwood	211	J 6
Page	9	C 7
Palmer	296	D 3
Palo	285	K 4
Panama	230	B 5
Panora	1,062	E 5
Paris	75	K 4
Parkersburg	1,300	H 3
Parnell	206	J 5
Paton	404	E 4
Patterson	133	F 6
Paullina	1,289	B 3
Payne	14	B 7
Pekin	75	J 6
Pella	4,427	H 6
Peoria	150	H 6
Peosta	60	M 4
Percival	250	B 7
Percy		G 6
Perkins	50	A 2
Perlee	22	K 6
Perry	6,174	E 5
Pershing	300	G 6
Persia	373	B 5
Peru	250	F 6
Peterson	589	C 3
Pierson	453	B 3
Pilot Grove	50	L 7
Pilot Mound	246	F 4
Pioneer	83	E 3
Pisgah	327	B 5
Plain View	42	M 5
Plainfield	387	J 3
Plano	106	G 7
Pleasant Plain	148	K 6
Pleasant Valley	500	N 5
Pleasanton	130	F 7
Pleasantville	893	G 6
Plover	243	D 3
Plymouth	395	G 2
Pocahontas	1,949	D 3
Polk City	336	F 5
Pomeroy	868	D 3
Popejoy	201	G 3
Portsmouth	299	C 5
Postville	1,343	K 2
Powersville	25	H 3
Prairie City	834	G 5
Prairieburg	210	L 4
Prescott	372	D 6
Preston	684	N 4
Primghar	1,152	B 2
Primrose	65	K 7
Princeton	495	N 5
Prole		F 6
Promise City	218	G 7
Protivin	283	J 2
Pulaski	381	J 7
Purdy		G 6
Quarry	204	H 4
Quasqueton	374	K 4
Quimby	398	B 3
Quincy		D 6
Radcliffe	638	G 4
Rake	351	F 2
Ralston	166	D 4
Randalia	132	K 3
Randall	202	F 4
Randolph	295	B 7
Rathbun	229	H 7
Raymond	260	J 4
Read		L 3
Readlyn	468	J 3
Reasnor	227	G 5
Red Oak	6,526	C 6
Redding	200	E 7
Redfield	892	E 5
Reinbeck	1,460	H 4
Rembrandt	296	C 3
Remsen	1,280	B 3
Renwick	474	E 3
Rhodes	369	G 5
Riceville	962	H 2
Richards	48	D 4
Richland	591	K 6
Richmond	140	K 6
Rickardsville	75	M 3
Ricketts	166	B 4
Ridgeway	307	K 2
Rinard	115	D 4
Ringsted	578	D 2
Rippey	354	E 5
River Jct.	36	L 5
River Sioux	135	B 5
Riverside	631	K 6
Riverton	472	B 7
Robertson	30	G 3
Robins	272	K 4
Robinson	50	K 4
Rochester	67	L 5
Rock Falls	139	G 2
Rock Rapids	2,640	A 2
Rock Valley	1,581	A 2
Rockdale	132	M 4
Rockford	979	H 2
Rockwell	753	G 3
Rockwell City	2,333	D 4
Rodman	123	D 2
Rodney	127	A 4
Roland	687	F 4
Rolfe	997	D 3
Rome	134	K 7
Roscoe	2	L 6
Rose Hill	243	J 6
Roselle	82	D 5
Ross	50	D 5
Rossie	112	C 2
Rossville		L 2
Rowan	304	F 3
Rowley	249	K 4
Royal	495	C 2
Rubio	70	K 6
Rudd	398	H 2
Runnells	307	G 5
Russell	566	G 7
Ruthven	868	D 2
Rutland	225	E 3
Ryan	362	K 4
Sabula	888	N 4
Sac City	3,170	C 4
Sageville	118	M 3
Saint Ansgar	981	H 2
St. Anthony	175	G 4
St. Benedict	135	E 2
St. Charles	319	F 6
St. Donatus	100	M 4
St. Lucas	158	K 2
St. Marys	89	F 6
St. Olaf	158	L 3
St. Paul	113	L 7
Salem	473	K 7
Salina	50	K 6
Salix	337	A 4
Sanborn	1,337	B 2
Sand Springs	50	L 4
Sandyville	92	G 6
Saratoga	85	J 2
Saylor	100	F 5
Scarville	105	F 2
Schaller	841	C 4
Schleswig	751	B 4
Scotch Grove	55	L 4
Scranton	891	D 4
Searsboro	183	H 5
Sedan	80	H 7
Selma	175	J 7
Seney	82	A 3
Sergeant Bluff	569	A 4
Sewal	100	G 7
Sexton		E 2
Seymour	1,223	G 7
Shambaugh	251	D 7
Shannon City	171	E 7
Sharpsburg	147	D 7
Sheffield	1,163	G 3
Shelby	592	C 5
Sheldahl	211	F 5
Sheldon	4,001	B 2
Shell Rock	1,013	H 3
Shellsburg	632	K 4
Shenandoah	6,938	C 7
Sherrill	162	M 3
Sherwood	21	D 4
Shueyville	75	K 5
Sibley	2,559	B 2
Sidney	1,132	B 7
Sigourney	2,343	J 6
Silver City	311	B 6
Sioux Center	1,860	A 2
Sioux City	83,991	A 3
Sioux Rapids	1,010	C 3
Slater	583	F 5
Sloan	654	A 4
Smithland	373	B 4
Soldier	323	B 5
Solon	527	L 5
Somers	217	E 4
South Amana	185	J 5
South English	248	J 6
Spechts Ferry	10	M 3
Spencer	7,446	C 2
Sperry	65	L 7
Spillville	363	J 2
Spirit Lake	2,467	D 2
Spragueville	115	N 4
Spring Hill	86	F 6
Springbrook	109	N 4
Springdale	72	L 5
Springville	680	L 4
Stacyville	544	H 2
Stanhope	420	F 4
Stanley	158	K 3
Stanton	570	C 7
Stanwood	547	L 5
Stanzel	25	E 6
State Center	1,040	G 5
Steamboat Rock	395	G 4
Stennett	28	C 6
Stiles	50	J 7
Stockport	346	K 7
Stockton	165	M 5
Stone City	200	L 4
Storm Lake	6,954	C 3
Story City	1,545	F 4
Stout	135	H 3
Strahan	100	B 7
Stratford	673	F 4
Strawberry Point	1,247	K 3
Struble	91	A 3
Stuart	1,500	E 6
Sully	452	H 5
Sulphur Springs	90	C 3
Summerset		F 6
Summitville	86	K 8
Sumner	1,911	J 3
Sunbury	100	M 5
Superior	240	D 2
Sutherland	835	B 3
Swaledale	205	G 3
Swan	194	G 6
Swea City	869	E 2
Swedesburg	104	L 6
Swisher	205	K 5
Tabor	869	B 7
Taintor	78	H 6
Talleyrand	24	J 6
Talmage	44	E 6
Tama	2,930	H 5
Tara	70	E 4
Teeds Grove		N 4
Templeton	385	D 5
Tennant	95	C 5
Terril	425	C 2
Thayer	152	E 6
The Inn		C 2
Thompson	698	F 2
Thor	271	E 3
Thornburg	138	J 6
Thornton	441	G 3
Thurman	284	B 7
Ticonic	35	B 4
Tiffin	256	K 5
Tingley	333	E 7
Tipton	2,633	L 5
Titonka	589	E 2
Toddville	200	K 4
Toeterville	75	H 2
Toledo	2,106	H 4
Toronto	165	M 5
Tracy		H 6
Traer	1,627	J 4
Trenton	104	K 6
Treynor	247	B 6
Tripoli	1,124	J 3
Troy	103	J 7
Troy Mills		K 4
Truax	60	H 6
Truesdale	158	C 3
Truro	354	F 6
Turin	160	B 4
Turkey River	9	L 3
Udell	96	H 7
Ulmer		D 4
Underwood	278	B 6
Union	490	G 4
Unionville	204	H 7
University Heights	446	K 5
University Park	457	H 6
Urbana	414	K 4
Urbandale	1,777	F 5
Ute	563	B 4
Vail	532	C 4
Valeria	57	G 5
Van Cleve	25	G 5
Van Horne	511	J 4
Van Meter	364	E 5
Van Wert	318	F 7
Vandalia	55	G 5
Varina	144	D 3
Ventura	300	F 2
Victor	741	J 5
Villisca	1,838	C 7
Vincennes	72	K 7
Vincent	193	E 3
Vining	112	J 5
Vinton	4,307	J 4
Viola		L 4
Volga	423	L 3
Voorhies	56	J 4
Wadena	316	K 3
Wahpeton	127	*C 2
Walcott	480	M 5
Walford	165	K 5
Walker	549	K 4
Wall Lake	753	C 4
Wallingford	229	D 2
Walnut	888	C 6
Wapello	1,755	L 6
Ware		D 3
Washburn	132	J 4
Washington	5,902	K 6
Washta	403	B 3
Waterloo	65,198	J 4
Waterville	199	L 2
Watkins	130	J 5
Waubeek	120	K 4
Waucoma	385	J 2
Waukee	501	F 5
Waukon	3,158	L 2
Waukon Jct.	40	L 2
Waupeton	11	M 3
Waverly	5,124	J 3
Wayland	600	K 6
Webb	235	D 3
Webster	136	J 6
Webster City	7,611	F 4
Weldon	229	F 7
Wellman	1,071	K 6
Wellsburg	744	H 4
Welton	93	M 5
Wesley	509	E 2
West		J 5
West Bend	772	D 3
West Branch	769	L 5
West Burlington	1,614	L 7
West Chester	218	K 6
West Des Moines	5,615	F 5
West Grove	90	J 7
West Liberty	1,866	L 5
West Mitchell	112	H 2
West Okoboji	158	C 2
West Point	662	K 7
West Union	2,141	K 3
Western College		K 5
Westfield	172	A 3
Westgate	226	K 3
Weston	75	B 6
Westphalia	160	C 5
Westside	393	C 4
Wever	100	L 7
What Cheer	1,119	J 6
Wheatland	568	M 5
Whiting	663	A 4
Whittemore	678	E 2
Whitten	174	H 4
Whittier	134	K 4
Wick	58	F 6
Willey	94	D 5
Williams	519	F 3
Williamsburg	1,183	J 5
Williamson	294	G 6
Wilton Jct.	1,446	M 5
Windsor Hts.	1,414	F 5
Winfield	888	L 6
Winterset	3,570	E 6
Winthrop	604	K 4
Wiota	227	D 6
Woden	272	F 2
Woodbine	1,304	B 5
Woodburn	255	F 7
Woodland		F 7
Woodward	908	F 5
Woolstock	255	F 3
Worthington	337	L 4
Wright	125	J 6
Wyman	100	L 6
Wyoming	724	L 4
Yale	293	E 5
Yarmouth	160	L 6
Yetter	121	D 4
Yorkshire		B 5
Yorktown	146	C 7
Zearing	514	G 4
Zook Spur	20	F 5
Zwingle	132	M 4

*No room on map for name.

A STATE OF GROWING INDUSTRIES



SENDING CORN TO MARKET "ON THE HOOF"



Iowa gets extra value for most of its huge corn crop by feeding it to meat animals and poultry. Beef cattle (top) are fattened to prime condition in a few months in feed lots. Hogs (bottom) thrive on corn and crop "leftovers" after the cattle have had their share.

roads. The state is also served by a number of transcontinental and local air lines.

Natural Resources and Conservation

One of Iowa's largest sources of power is the hydroelectric plant at the Keokuk Dam across the Mississippi. It supplies electric current to neighboring communities and to many cities, including St. Louis 145 miles away. This dam, nearly a mile long with installations extending 1¾ miles, develops more than 200,000 horsepower. Other hydroelectric plants are located on the Mississippi and Missouri. Additional power comes from bituminous coal mined in the central part of the state. Other important minerals are cement, stone, sand and gravel, and gypsum.

Most of Iowa's timberlands are found in small tracts ranging from two to several hundred acres. These trees supply about 10 per cent of the total volume of lumber used in the state. Most of the remainder comes from the forests of Minnesota and Wisconsin.

In 1933 Iowa began a 25-year program to rebuild and conserve its natural resources. The State Conservation Commission directs most of this work. Its Fish and Game Division manages the wild-life refuges and hatcheries. Its Division of Land and Waters deals with reforestation, soil fertility, and the conservation of surface and subsurface water.

Farms and Small Towns

The life of most Iowans is directly related to the soil. More than half of the people live on farms or in towns of less than 2,500 inhabitants. As a result the population is fairly evenly distributed throughout the state. The average density is about 47 persons to the square mile, or slightly less than the national average.

About every half mile stands a farmstead with its white frame house, its great red barn, and cluster of smaller buildings. Every few miles the farms give way to a small market town. Here grain elevators, creameries, and stock pens serve as local collecting points for the products of the region. Each town is also a retail trading center, supplying the everyday needs of the community. The yield of the farms and the trade of the small towns have created a high and balanced standard of living for their people.

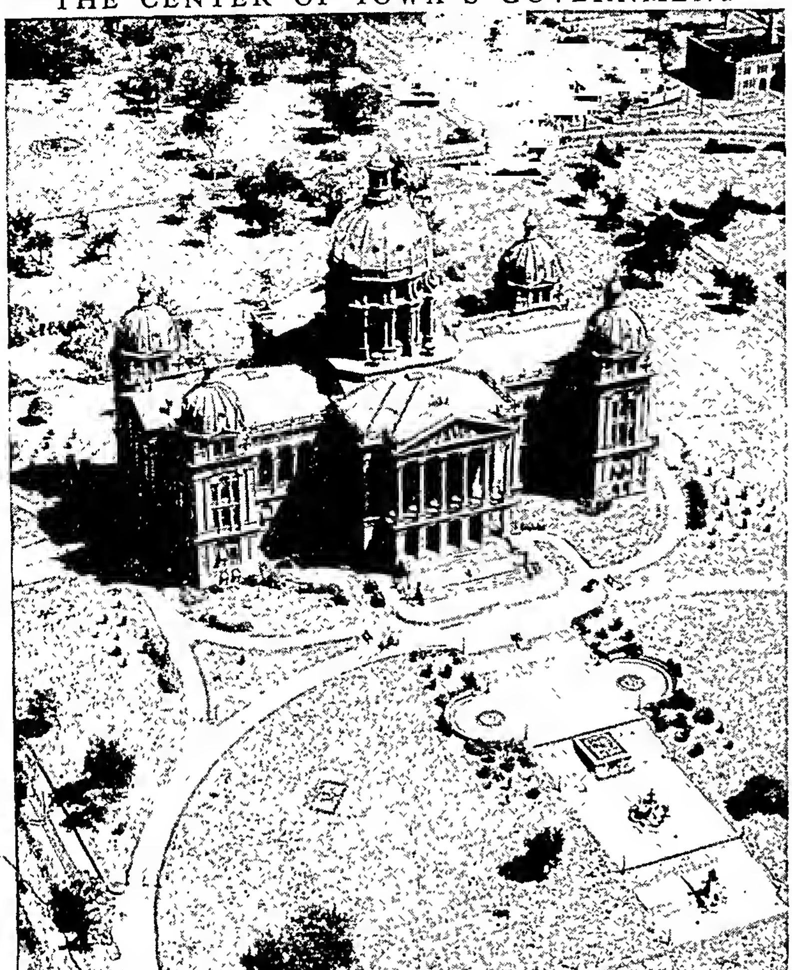
Cities of the "Hawkeye State"

Only one Iowa city, Des Moines, has more than 150,000 residents. This city of broad avenues and spacious parks owes much of its growth to the fact that it is Iowa's capital. Located on the Des Moines River near the middle of the state, it is the center of a rich corn-growing region as well as a busy industrial city. Its leading newspaper, the Des Moines *Register and Tribune*, has been called "the voice of the Iowa farmer." The city is also the site of the state fair held each August (*see* Des Moines).

An important manufacturing and wholesale center is Sioux City, on the wooded bluffs where the Big Sioux and Floyd rivers flow into the Missouri. The second largest city in the state, it lies at the junction of Iowa, Nebraska, and South Dakota. Council Bluffs, further south on the Missouri, is a railroad center, farm market, and manufacturing city.

The oldest cities are on the eastern border along the Mississippi. Dubuque is picturesquely divided between a lower and upper city. Business and industry occupy the low-lying river bank; the residential district is set high on bluffs. Clinton, city of beautiful elms, was once a lumbering town. It is now a

THE CENTER OF IOWA'S GOVERNMENT



This Fairchild Aerial Surveys view shows the imposing State Capitol of Iowa looming above the city of Des Moines. Its gilded dome is patterned after that of the Hotel des Invalides in Paris, France. The building cost $3,296,256 and was built in 1873-86.

railroad and milling center and the site of the first cellophane plant west of the Mississippi.

To the south is Davenport, another large city. With Rock Island and Moline, its Illinois neighbors across the Mississippi, it forms the Tri-Cities (with East Moline, called Quad-Cities). Muscatine, just below Davenport, is noted for its manufacture of pearl buttons from shells taken from the Mississippi River. Burlington, important ferry terminal in Iowa's early days, is now a manufacturing and distributing center with municipal docks and railroad shops.

About 50 miles west of the Mississippi lie three of Iowa's major cities. The northernmost of these is Waterloo, noted for its meat packing and manufacture of farm implements. The city holds an annual cattle, horse, and poultry exposition that attracts visitors from all over the nation. Cedar Rapids is the commercial hub of east-central Iowa. The city spreads over the wooded knolls along the Cedar River. Iowa City is an industrial, medical, and educational center located on both sides of the Iowa River. Farther southwest is Ottumwa, divided into two communities by the Des Moines River. The "hill section" north of the city overlooks food-processing and meat-packing plants.

In north central Iowa are four important cities. At Mason City, railways and bus and truck routes meet on their way to the northern and western United States. The city is a processing center for farm products. Fort Dodge, on the Des Moines River, is noted for mining and manufacturing gypsum. Marshalltown is an industrial, trade, and railroad hub on the Iowa River. It is the site of the Iowa Soldiers' Home. Ames is an educational and industrial city on the Skunk River. The Ames Atomic Energy Laboratory is located here.

An Excellent School System

Because of its large rural population, Iowa was once known as the state of "the little red schoolhouse." At one time it had more than 10,000 separate school buildings. But each year many of these one-room elementary schools are replaced by large consolidated schools providing superior educational advantages. Special buses serve these districts, carrying the students to and from school.

Today Iowa's educational system ranks with the best in the world. The state's percentage of illiteracy is 0.8 per cent, the lowest in the nation. This figure is less than one third of the 2.7 per cent average for the United States as a whole.

The State University of Iowa at Iowa City and the Iowa State College of Agriculture and Mechanic Arts at Ames have contributed greatly to the development of the state. The State University of Iowa has done outstanding work in social welfare. Its University Hospital is one of the nation's finest medical units. It is especially noted for its work in children's orthopedics—the correction of deformities. Agricultural research at Iowa State College has been a powerful influence in improving Iowa farming practices. A third state-supported school is Iowa State Teachers College at Cedar Falls. The state also maintains special schools for physically and mentally handicapped children.

Other well-known Iowa institutions for higher education are Coe College, at Cedar Rapids; Cornell College, at Mount Vernon; Drake University, at Des Moines; Grinnell College, at Grinnell; Loras College, at Dubuque; Morningside College, at Sioux City; and Parsons College, at Fairfield.

Iowa's Government and State Policies

Iowa is governed under the provisions of its second constitution, adopted in 1857. Every 10 years since 1870 the people vote on the question of calling a convention to frame a new constitution. To win ap-

proval, the question must receive a majority of the votes cast on the proposal. The state legislature is then authorized to assemble such a convention. The present constitution provides for a legislature, consisting of the Senate and the General Assembly; an executive, vested in the governor and other state officials; and a judiciary, composed of the Supreme Court, district courts, and municipal and superior courts as authorized by the legislature.

Each city and town has the choice of adopting a commission, manager, or mayor-council form of government. Four cities, Muscatine, Davenport, Camanche, and Wapello, are governed under special charters dating from pioneer days.

The people of Iowa are proud of their contributions to the nation and their progressive state policies. Before the Civil War the state was overwhelmingly against slavery. More than 75,000 of its men (almost one-tenth of the population) fought for the North. Iowa was one of the first states to enact a prohibition law (1884), and Des Moines was the first city in the nation to adopt the commission form of government. Iowa was also a pioneer in adopting direct primaries (1907). A civil rights act (1939) gives all persons "full and equal enjoyment" of public places.

In state and national politics Iowa normally votes Republican. Under its present constitution the state has chosen a Republican governor at every election except 1889, 1891, 1932, 1934, and 1936. Iowa has cast its electoral votes for a Democratic presidential candidate only in 1912, 1932, 1936, and 1948.

Early History of Iowa

The French explorers Marquette, Joliet, and Hennepin touched the borders of Iowa in the latter part of the 17th century. But there were few white settlements in the area until after 1788. In that year Julien Dubuque set up a trading post and developed a lead mine near the present city of Dubuque. Soon Iowa's many fur-bearing animals attracted trappers and traders. Small trading posts sprang up along the Mississippi and other rivers, and these settlements later became the first towns. Very few of these hardy adventurers attempted to work the land.

During this time hunting bands of Indians roamed over Iowa's broad prairies. In the west were the tepees of the Omaha, Oto, and Missouri tribes. From the north warlike Sioux rode down to raid the Sauk and Fox tribes who had crossed the Mississippi from the Illinois country. The Potawatomi settled in the southwest while the Mascouten and the Winnebagos made their home along the Mississippi. Near the banks of the Des Moines River were the villages of the Iowa or Ioway Indians, a Sioux tribe from the Great Lakes region. From these Indians comes the name of the state.

In 1832 Chief Black Hawk of the Sauks surrendered the Indians' claim to eastern Iowa (Black Hawk Purchase). At that time not more than 50 white men had permanently settled in the Iowa country. But by 1850 a steady stream of pioneers had swelled the population to 192,000. This heavy migration was stimulated by reports sent back by explorers such as Col. Zebulon M. Pike who surveyed the upper Mississippi Valley in 1805. These men were impressed by the thick carpet of tall grass on the prairie uplands and the heavy stands of hardwood trees along the river bottoms.

Pioneers Settle Iowa

Most of the early settlers came from eastern states. The heaviest flood of European immigrants came between 1856 and 1885, when almost 225,000 people settled in what is now Iowa. These were chiefly Irish fleeing famine, and Germans, Dutch, and Scandinavians escaping political revolutions and religious oppression in their native countries.

One group of pioneers was a religious society of about 800 Germans who migrated from New York to Iowa in 1855. Unlike the other settlers they formed a separate community in the east-central part of the state. In 1858 they took the name of Amana Society. These people lived as a communal group until 1932 when the society was reorganized as a business corporation.

Some of the earliest settlers arrived by overland wagon trains. But most of them came up the Mississippi River by steamboat. They settled in towns along the river and shipped their produce to St. Louis in return for manufactured goods. In the 1850's, however, railroads reached the state from Chicago and the direction of trade shifted to east and west.

Pressed by the swelling army of settlers, several Indian tribes waged war on the white men. But they failed to stem the relentless westward expansion and in 1851 surrendered the last of their land. Several brief uprisings followed, but the massacre of the whites at Spirit Lake in 1857 was the last.

Territory and Statehood

In 1812 Iowa became a part of the Missouri Territory. After that, it was included in the Michigan and later the Wisconsin Territory. In 1838 the Iowa Territory was organized with the legislature meeting at Burlington. On December 28, 1846, Iowa was admitted to the Union as the 29th state with a population of 102,338. It was the first "free state" carved out of the Louisiana Purchase. Iowa City was the capital until 1857 when the second constitution transferred the seat of government to Des Moines.

During the 1860's Iowa was the center of the Grange movement. Its members advocated lower railroad shipping rates and higher prices for farm products. Beginning about 1920 the Farm Bureau Federation replaced the Grange as the principal spokesman for the Iowa farmer. In the 1880's chinch bugs swarmed over the wheat fields of the state. But what seemed like a disaster proved to be a benefit, for Iowa's farmers then turned to the raising of corn and corn-fed livestock—the chief basis of the state's prosperity.

Since 1920 emigration from the state has kept Iowa's population fairly stable at about 2,500,000. Between 1940 and 1947 Iowa registered 181,000 more births than deaths; yet during this period more than 100,000 people moved out of the state. This emigration reached a peak in World War II and has diminished since then. (*See also* chronology in Iowa Fact Summary; United States, section "North Central Plains.")

IRAN—"*the* LAND *of the* LION *and the* SUN"

IRAN (ē-rän′). The people of "the Land of the Lion and the Sun" have been called Persians by western people since ancient Greek times. But they have always called themselves Irani (Aryans); and in 1935 they made Iran the official name of their country.

Extent.—North to south, about 860 miles; east to west, 1,385 miles. Area, about 628,000 square miles. Population (1948 est.), 17,000,000.

Physical Features.—Western half of Iranian Plateau (general altitude, 3,000 to 5,000 feet), crossed by numerous mountain ranges (Mount Demavend, 18,550 feet); salt and sandy deserts cover about two thirds of the plateau area. Salt lakes, Seistan and Urmia. Caspian Sea on north, Persian Gulf and Gulf of Oman on south; only navigable river, Karun.

Principal Products.—Wheat, barley, cotton, tobacco, rice, sugar beets, dates, figs; opium; wool and Persian lambskins; petroleum; iron, copper, lead, coal, turquoise, salt; rugs and carpets.

Chief Cities (1946 est.).—Tehran (capital, 554,372); Tabriz (258,868); Isfahan (183,597); Meshed, Shiraz, Resht, Hamadan (over 100,000).

Iran lies in southwestern Asia between the Caspian Sea in the north and the Persian Gulf and Gulf of Oman in the south. It covers a large area (628,000 square miles), but is sparsely populated.

A High Dry Land

Iran occupies the western and larger part of the high, dry Iranian Plateau. The lofty Elburz Mountains wall the country on the north and the Zagros chain slants down the western border. Lesser chains cross the plateau from northwest to southeast. The highest peak is Mount Demavend (18,550 feet), a great volcanic cone in the Elburz Range. The only navigable river is the Karun, which joins the estuary Shatt-el-Arab close to the Persian Gulf. Most of the other rivers empty into dry interior basins or into salt lakes.

The plateau lies at heights of from 3,000 to 5,000 feet above sea level. The eastern third is covered by lifeless salt deserts; the rest is much like the dry regions of the western United States. The mountains are treeless but provide sparse grass for sheep and goats. At the foot of the mountains are scattered green oases, watered by streams or underground springs. Each oasis is the site of a town or village of close-packed mud houses.

In summer the plateau is practically rainless. Winter rain and snow supply an annual precipitation of about 15 inches in the west and 5 inches in the east. In winter the temperature drops as low as 20°F.; in summer it soars above 100°. Along the Persian Gulf and the Gulf of Oman the climate is even hotter and very humid; but there is little rainfall. Rain is heavy on the Caspian coast—about 50 inches a year.

The People Are Friendly and Courteous

The people belong to the Indo-Iranian branch of the white race. They are extremely courteous and hospitable. They like to sit with their friends in tea houses, drinking glass after glass of sweetened tea and talking endlessly. Their language, Persian, is one of the most flowery in the world.

The land of each village belongs to a landlord who usually lives in a city. He collects as rent from a third to two-thirds of the farm produce. The peasants live in hovels and have little personal property. They eat whole-wheat bread baked in round flat loaves, with some cheese and kurd, onions, cucumbers, and fruit. Meat is a rare treat.

On most of the plateau the peasants can grow crops only by irrigation. Since rivers are few, water must be obtained from underground springs. To prevent evaporation in the dry air, the springs are tapped near the base of seemingly dry mountains, and the water is brought down through ingenious tunnels, called *kanats*. At the end of each kanat, the water is delivered to irrigation ditches.

Seminomadic tribes make up about a quarter of the population. They pasture fat-tailed sheep and goats on desert ranges and in the mountains, moving up the slopes in summer and down in winter. The Kurds and Lurs, descendants of old Persian stock, live in the western mountains. The Turkomans and Baluchis live in the east. The nomads provide the villagers with meat, milk, hides, and cheese. They are skilled in handicrafts, particularly carpet weaving. Each tribe has its particular pattern.

An Iranian city is enclosed by high mud walls, pierced by colorful patterned gateways made of glazed tiles. Each craft occupies its own section in the *bazaar* (business district). Every house, no matter how poor, has some sort of garden, enclosed by a mud wall. The garden is a miniature landscape, laid out formally with a tiled pool in the center. In the season of roses the Persian garden is everything the poets boast of. The Iranian never speaks of his house at all —only of his garden. It is assumed it has a house in it.

Tehran, the Beautiful Capital

Tehran, the capital, is the largest city in Iran. It lies on the plateau, 70 miles south of the Caspian Sea. The Elburz Mountains, crowned by snow-clad Mount Demavend, half encircle the city on the north. Camel caravans stop at the outskirts, for only automobiles, trucks, and busses are permitted on the wide avenues, lined with trees. The shah lives in a modern palace and sits on a new throne of alabaster. But his palace still holds the famous Peacock Throne of old Persia, with two carved peacocks on the back. Their spread tails glitter with rubies, pearls, and emeralds.

Second in size is Tabriz in the northwest. It is the trade center for an important agricultural province, Azerbaijan (population, 1948 est., 2,734,973). Isfahan, the 17th-century capital, is the art shrine of the country. Of the great days of ancient Persia—the days of Cyrus and Darius—little remains except the lonely ruins of Persepolis, in the southern mountains.

Religion and Education

The vast majority of the people are Moslems; but they are of the Shiite sect (*see* Mohammed). They make pilgrimages to Mecca, the holy city of all Moslems; but they also have a holy city of their own—Meshed, in northeast Iran. A small number of Iranians still practice the ancient religion of Persia,

Zoroastrianism (*see* Zoroaster). There are some Jews, Christians, and Baha'is (*see* Baha'u'llah).

The government has tried to make elementary schooling free and compulsory, but most of the villages still have no schools. The chief institution of higher learning is the University of Tehran, founded in 1935.

Girls are admitted to the government schools, including the University of Tehran. Women generally have discarded the traditional dress (black trousers and an all-enveloping black veil) for European style clothes. Polygamy is almost unknown among the upper classes and is dying out even among the peasants.

Products and Natural Resources

On the plateau the peasants raise barley, wheat, Indian corn, cotton, sugar beets, poppies for opium, grapes, Persian melons, and vegetables. The Persian Gulf coast grows chiefly dates. The warm, rain-drenched Caspian coast—the most fertile area in Iran—produces rice, tea, tobacco, and many fruits; and its luxuriant forests furnish excellent timber as well as charcoal for fuel. Iran shares with Russia the Caspian Sea fisheries. The Caspian is famous for its sturgeon, which yields caviar.

Mines and oil reserves belong to the government. The chief oil field is at the head of the Persian Gulf. A pipeline carried the oil to the world's largest refinery at Abadan. In 1933 Britain gained the right to operate the field, but in 1951 Iran nationalized oil. Low-grade coal is mined in the Elburz Range, and some lead, copper, salt, and turquoise are mined.

The government is attempting to revive the beautiful handicrafts of old Persia—miniature painting, silver and inlay work, and carpet weaving. The only other important industries are sugar refining and other food processing and the manufacture of cotton and woolen cloth. The state owns most of the large factories and regulates foreign trade. The chief exports are oil, carpets, raw wool, lambskins, dried fruits, and gum tragacanth.

Motor roads are fast replacing the old camel trails. The chief railway is the Trans-Iranian, completed in 1938. It runs 865 miles from Bandar Shahpur on the Persian Gulf to Bandar Shah on the Caspian Sea, passing through Tehran. To cross the mountains it passes through 224 tunnels and requires 4,102 bridges.

Iran Struggles to Become a Nation

The Iranians look back on 2,500 years of recorded history (*see* Persian History). As a modern state, however, Iran is young. Its story may be said to begin with the 20th century.

In 1900 the Shah of Persia still ruled as an absolute monarch. In 1906 the people accomplished a revolution by extraordinary means. Some 16,000 simply took refuge in mosques until the Shah agreed to grant them a constitution and a legislative assembly. Before the year ended the first Persian parliament (Majlis) was called, and a constitution was adopted.

Russia and Great Britain had long competed for control of Iran. Russia wanted a warm-water port on the Persian Gulf. Britain, to protect its "life line" to India as well as its oil concessions on the Gulf, had held Russian penetration to the northern provinces. In 1907 the two powers agreed to recognize each other's "sphere of influence." Between the two, Iran was left with a "neutral strip"—the salt desert. In 1911 it called in an American, W. Morgan Shuster, to reorganize the country's finances. Russia forced his dismissal at the end of the year.

Germany meanwhile had been laying plans to continue the Berlin-to-Baghdad railway across Iran, and its agents became active in the country. When the first World War broke out, Iran became a battlefield, with British and Russians fighting Turks and Germans. In 1919 Britain drew up a plan to extend its influence over all Iran. But the next year Russian troops occupied the Caspian provinces. The mountain tribes revolted and anarchy reigned.

Reza Khan Becomes Dictator

When ruin seemed almost complete, Reza Khan, colonel of a cavalry division, marched on Tehran with 2,500 men (February 1921). His emergency government quickly restored order. In 1923 he became prime minister, with dictatorial powers. In 1925 the Majlis deposed the absent shah (Ahmed) and proclaimed Reza the shah of Persia, first of a new dynasty called Pahlavi.

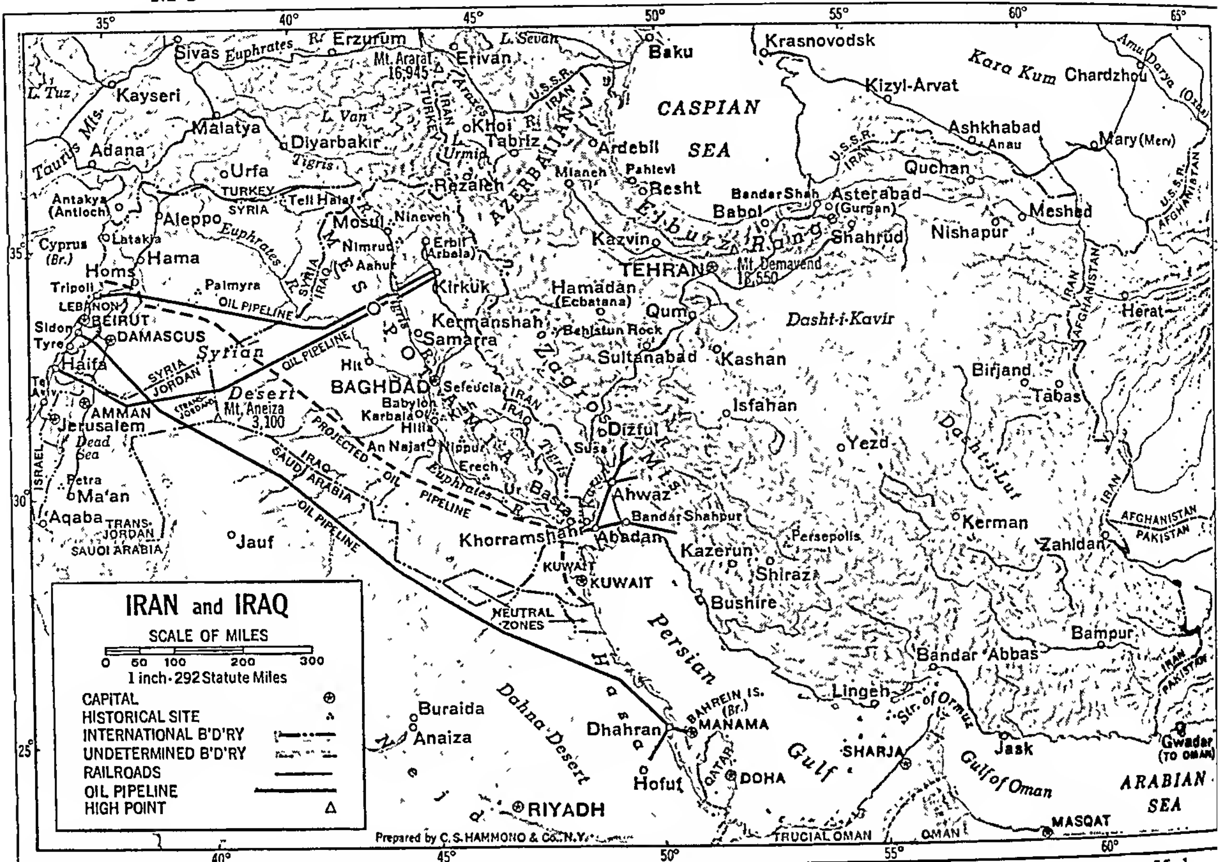
Reza's government nullified the agreement of 1919 with Great Britain; persuaded Russia to withdraw from the northern provinces; and brought in an American mission, headed by Arthur C. Millspaugh, to reform finances and give technical assistance. Revenues were increased, the Trans-Iranian railway was begun, and many highways constructed.

In 1927 Reza abruptly dismissed the American mission and called in German experts. When Germany brought Russia into the second World War, the Allies

ARCHITECTURE OF OLD PERSIA

Among Tehran's modern buildings stands the College of Theology. Its minarets and dome glow with light reflected by glazed, colored tiles, arranged in beautiful designs.

MOUNTAINOUS IRAN AND THE LOW VALLEY OF IRAQ



Like the rest of southwestern Asia, Iran and Iraq are dry lands. Rain falls only in winter and decreases eastward from the Mediterranean. The most productive area is the low Tigris-Euphrates Valley (Mesopotamia) in Iraq. On Iran's mountain-rimmed plateau, oases are small. The rivers tend to dry up during the hot summer. Both Iran and Iraq are rich in oil.

needed the Trans-Iranian railway to Russia. In August 1941 the British invaded Iran from the south and the Russians from the north. The Iranian army quickly collapsed and Reza Pahlavi abdicated in favor of his 22-year-old son, Mohammed Reza Pahlavi. In 1942 American forces began improving transportation facilities to move war supplies to Russia. The Americans brought in freight trains, enlarged ports, extended highways, and built assembly plants.

Iran declared war on Germany in 1943. Roosevelt, Churchill, and Stalin conferred at Tehran. They issued a declaration guaranteeing Iran's independence.

But in 1945 Russia aided the Iranian Communist party *Tudeh* (Masses). Helped by Russia, Tudeh instigated a revolt in Azerbaijan. Iran protested to the United Nations in 1946. Russia then withdrew its troops, and Iran regained control of Azerbaijan.

An American military commission began to train the Iranian army in 1949. Iran outlawed Tudeh after an effort to kill the shah, but it continued secretly. In 1951 Premier Mohammed Mossadegh nationalized the oil industry, which Britain had controlled. The loss of revenue nearly bankrupted Iran. Mossadegh, in 1953, tried to become dictator, forcing the shah to flee. An army revolt, however, ousted Mossadegh and returned the shah. In 1954 Iran took steps to permit foreign companies to reopen the oil fields.

IRAQ (*ĭ-räk'*). The Arab kingdom of Iraq is known to history as Mesopotamia ("the land between the rivers"). The two largest rivers of southwestern Asia—the Tigris and Euphrates—traverse the country from northwest to southeast. The silt of these rivers has built a long alluvial plain and delta so fertile and fair to desert eyes that legends place in it the Garden of Eden. Here was perhaps the first land to see the dawn of civilization (*see* Mesopotamia). Modern Iraq was created in 1920 when Turkey's vast Ottoman Empire was dismembered, following the first World War.

Iraq is a little larger than California and roughly triangular in shape. Two-thirds of the country is a monotony of flat desert and brown steppes. On the west the sands merge with the Syrian and Arabian deserts. In the north and northeast, where Iraq borders on Turkey and Iran, narrow green valleys lie at the foot of rugged hills and mountains. Most of the people live close to the two great rivers, especially in the south, where they unite to form the Shatt-el-Arab, 120 miles from the head of the Persian Gulf. (*See* Euphrates River; Tigris River.)

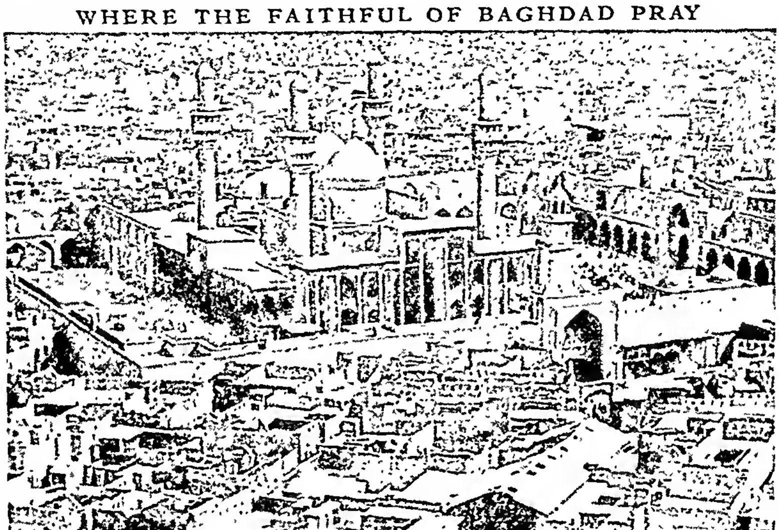
In early times highly developed irrigation systems produced abundant crops and nourished great cities. Centuries of war and the shifting of river beds destroyed these systems and returned much land to desert. Ancient Babylon and Nineveh have long lain in ruins.

But the government has undertaken large irrigation projects, and 4,000 square miles of land now produce fine crops. Iraq supplies about 80 per cent of the world's date output and nearly all the dates imported into the United States. It also exports barley, wheat, and other cereals; wool and cotton; sheep and goat skins, horses, and camels.

Rich Petroleum Field

One of the richest petroleum deposits in the world is the Mosul oil field, far up the Tigris. The Mosul area, claimed by Turkey after the first World War, was given to Iraq by the League of Nations in 1926. An international controversy over ownership of the oil field ended in formation of the Iraq Petroleum Company. Control of IPC is shared about equally by British, American, Dutch, and French oil companies. Oil began to flow in 1934 to the Mediterranean through two famous pipe lines from Kirkuk. These lines, 1,165 miles in length, run side by side across the Tigris and Euphrates rivers and then split, one going to Haifa in Israel and the other to Tripoli in Lebanon. Today Iraq is one of the largest oil-producing nations in the world and receives large royalties from the company. Near Hit, on the Euphrates, are asphalt deposits.

WHERE THE FAITHFUL OF BAGHDAD PRAY



The Kadhimain Mosque with its four minarets is set in a welter of flat-roofed houses built about courtyards, typical of Arab cities.

The Arabs make up more than 90 per cent of the population. They are about equally divided between the Sunnite and Shiite sects of Mohammedanism. Karbala, Najaf, and Samarra are noted Moslem pilgrim centers. Strange religions are those of the Yezidis, devil worshipers, and of the Sabians, star worshipers. The latter must live in river towns because their ritual calls for running water.

Among the ruins of the old irrigation canals on the lower river live the swamp Arabs in their reed huts. Safe in tiny hamlets on islands between the twisting channels which they alone know, they were never conquered by the Turks. They claim descent from the first historic dwellers of the plain, the Sumerians, and they believe that the swamp waters are the remains of the great flood of biblical times.

In Baghdad, the capital, the intense summer heat, often 122° F., drives the people to a cellar called the *serdab*. It has a ventilating shaft with an opening which can be turned to catch every breath of the northwest wind (*see* Baghdad). On summer nights, people seek the roofs for comfort and find the shabby old city transformed as moonlight glistens on the spires and domes of the many mosques in narrow, winding streets. In winter sharp cold penetrates the fluttering rags of the street beggars.

Far down on the Shatt-el-Arab is the date-palm city of Basra, legendary port of Sinbad. Here in September the "date wind," with its steaming breath of the Gulf, ripens the crop. Since 1938 Iran (Persia) has shared the harbor, which is crowded with oil tankers and native craft that transfer cargoes to ocean vessels.

Baghdad and Basra are important airports on the shortest air route between Europe and Asia. They are also on the history-making "Berlin-to-Baghdad" railway. Completed in 1940, the railway extends throughout Iraq and connects it with Turkey and Europe. Many motor roads have been built.

The long rule of the Turks over Mesopotamia as part of the Ottoman Empire was broken in the first World War. Great Britain was given a mandate for the new nation of Iraq in 1920. Faisal was crowned king the next year. In 1930, a 25-year treaty was signed, allowing Britain military bases and providing for Iraq's independence after it had joined the League of Nations. This it did in 1932.

Iraq is a constitutional, hereditary monarchy. It has a Parliament with a Senate of 29 members appointed by the king, and a Lower House of 138 elected deputies.

On the death of Faisal in 1933, Prince Ghazi became king. He died in 1939 and was succeeded by his three-year-old son, Faisal II, under a regency.

In 1941, a German fifth column inspired a revolt which threatened Iraq's vital oil fields and the entire Near East with Axis domination. British forces occupied the country and re-established the old order.

From the beginning of the second World War, Iraq played a strategic part as an overland link in the supply route through the Persian Gulf to Russia. It was also a great Allied military base and a rich source of oil. In 1943 Iraq became the first Arab nation to declare war on the Axis and thereby reduced the threat of German and Japanese forces meeting along the Persian Gulf.

Iraq and other Moslem states formed the Arab League in 1945 (*see* Arabia). The Iraq army helped to invade Palestine in 1948. In 1952 Iraq renewed the IPC contract and gained equal share in the oil profits. British-schooled Faisal II, 18 years old, began active rule in 1953; in 1954, Iraq received American arms aid. Area, about 170,000 square miles; population (1947 census), 4,799,500.

IRELAND—*The* REPUBLIC *on the* EMERALD ISLE

The ruins of Blarney Castle stand in a wood five miles northwest of Cork. The famous Blarney Stone is on the outside wall of the tower beneath a high window. Anyone who kisses this stone is supposed to acquire the power of persuasive speech.

IRELAND. The island of Ireland is the second largest island of the British Isles. The Republic of Ireland occupies five-sixths of it. The other sixth, in the northeast corner, is Northern Ireland. Northern Ireland is still united politically with Great Britain (*see* Ireland, Northern). The Republic of Ireland has been completely independent since 1949, when it cut its last tie with the British Commonwealth of Nations.

The early Irish called the island *Eire*, or *Erin*. The English called it Ireland (*Eire-land*). In 1937 the southern Irish chose the name Eire for their country. In 1949 they changed the name to Ireland.

The republic covers an area of 26,601 square miles—about the size of West Virginia. It consists of 26 counties grouped in four provinces: Munster in the south, Leinster in the east, Connaught in the west, and Ulster in the north. Ulster contains three of the nine counties that made up the former province of Ulster. The other six counties constitute Northern Ireland.

Emigration has cut down the population of southern Ireland. In 1845 it had about 6,000,000 people. Today it has 2,960,593. There are more people of Irish descent in the United States than in the homeland. Irish are numerous also in the British dominions and in Great Britain itself.

A Green Plain Rimmed by Mountains

The republic has only one land boundary—the boundary with Northern Ireland. In the northwest, west, and south it looks out on the Atlantic Ocean. In the east the shallow Irish Sea, an arm of the Atlantic, separates it from the island of Great Britain. Across St. George's Channel, at the southern end of the Irish Sea, it is only 47 miles from Wales.

The surface of the island has often been compared to a saucer. The center is a marshy plain underlaid with limestone. Mountains rim the shore and spread far inland in the north and south. The principal break in the mountain rim is in the east, north of Dublin, where the shore is low and sandy. In the west, sheer cliffs rise from the sea. Here the coast is pierced by bays and fringed with rocky islands. The highest point on the island is Carrantuohill (3,414 feet), in County Kerry, in the southwest. It is in the range called Macgillicuddy's Reeks, which frames the beautiful lakes of Killarney (*see* Killarney).

On the central plain, green pastures alternate with dark-brown expanses of peat bog. The plain is drained by many rivers and studded with countless lakes, called *loughs*. The River Shannon, the longest river in the British Isles, swells out into many broad loughs as it winds lazily south and west to the Atlantic. As it nears Limerick, at the head of a broad estuary, its flow becomes rapid. The chief rivers in the south are the Barrow and the Blackwater; in the east, the Liffey, which flows into Dublin Bay, and the Boyne, farther north. The charm of Irish scenery lies in the fresh, green countryside, where one is seldom out of sight of hills and water.

The prevailing winds in Ireland are from the south

Extent.—North to south, about 250 miles; east to west, 170 miles. Area, 26,601 square miles. Population (1951 census), 2,960,593.

Physical Features.—Central plain bordered by small mountain ranges; highest point, Carrantuohill (3,414 feet). Chief rivers: Shannon, Blackwater, Liffey, Lee, Barrow. Numerous lakes and islands.

Products.—Cattle, hogs, poultry and eggs, horses, sheep; hay, potatoes; turnips, mangels, sugar beets, cabbage, wheat, oats, barley, dairy products, bacon, brewing, sugar refining, woolen textiles, clothing.

Cities.—Dublin (capital, 523,183); Cork (74,567); Limerick (50,820); Dun Laoghaire (formerly Kingstown, 47,920).

and southwest. These winds, coming from the Atlantic, are moist winds. Ireland is the first land they meet with as they travel eastward. Its rainfall, therefore, is even greater than that of Great Britain. On the south and west coasts it rains, on the average, two days out of three the whole year round—up to 56 inches a year. Dublin, on the east coast, has about 28 inches.

Ireland lies farther north than Newfoundland; but it is on the warm side of the Atlantic. A branch of the ocean current called the Gulf Stream strikes its southwest coast. This water warms the air and gives Ireland a winter temperature higher by some 20 degrees F. than that of other places in the same latitude. The temperature varies little from summer to winter—no more than 15°F. in the southwest. In Dublin the lowest January temperature is about 37° and the highest July temperature about 66°.

Green Pastures and Peat Bogs

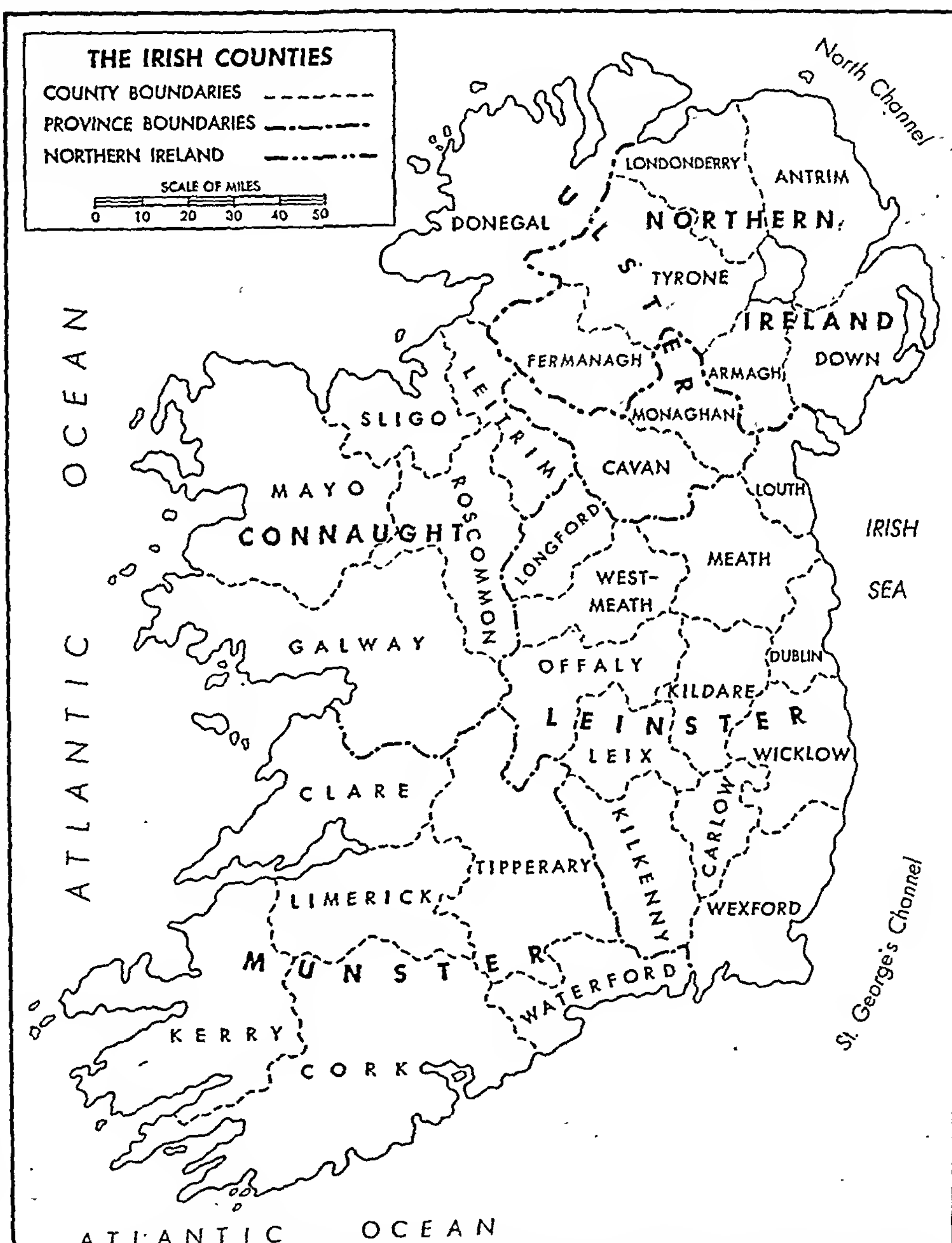
Ireland is almost bare of trees. Less than one and one-half per cent of its surface is in forest. But wherever there is drainage enough to prevent marshes the abundant moisture produces lush grass. This covering gives Ireland the name of the Emerald Isle. Wherever drainage is poor, there are peat bogs. A bog is spongy ground made up of vegetable matter in various stages of decay. On low ground, the bogs are more than 50 feet deep in places. The great Bog of Allen, in the basin of the Shannon River, covers a large part of the central plain. Shallow deposits are extensive in the uplands, particularly along the western seaboard. The drier east is almost peat free.

The Irish call peat *turf*. They cut the sods, drain and dry them, and use the peat for fuel. In many places they have entirely cut away the bogs. But it is estimated that 2,000,000 acres remain.

The Irish People

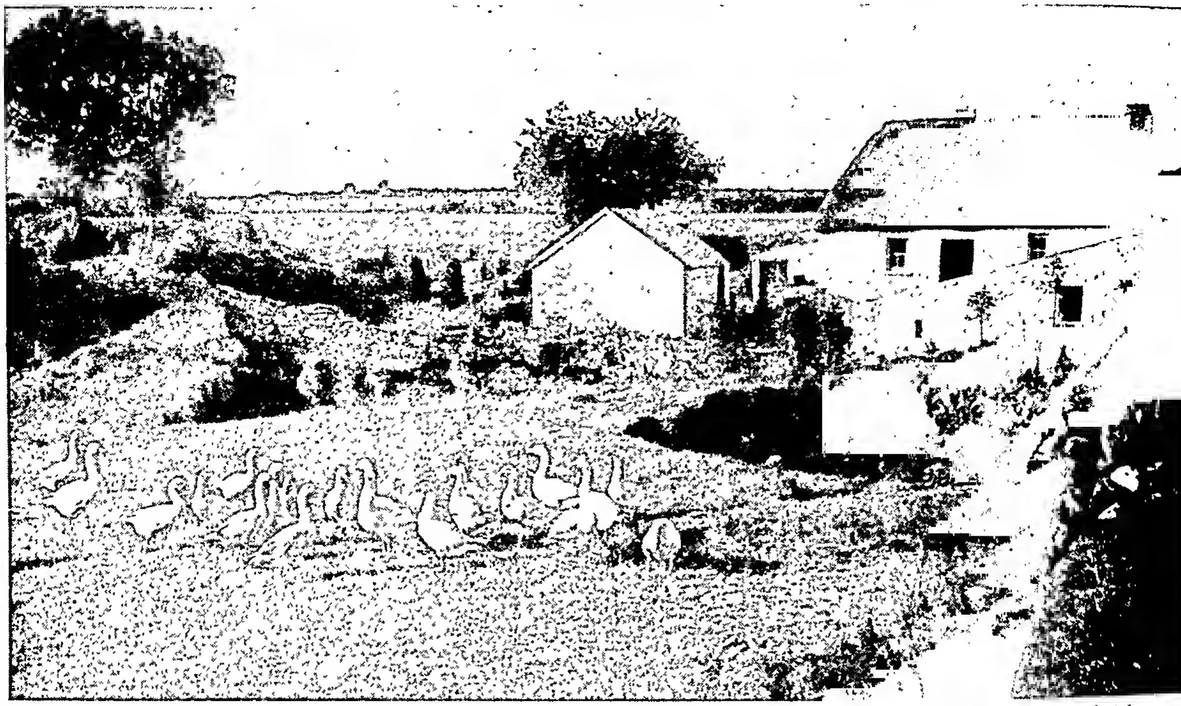
The Irish are a talkative and witty people, impulsive, imaginative, and courageous. They are descended from the Gaels, a branch of the ancient Celts; and their customs and folk tales still preserve a wealth of Celtic tradition (*see* Celts). Country people talk of "fairies," or the "wee people," who bring good luck or punishment, according to how they are treated. There are many superstitions connected with birds and trees. These primitive beliefs exist side by side with devout religious piety. About 94 per cent of the people are Roman Catholics. Every small hamlet has its church, and everywhere the black-frocked priest is a familiar figure.

Centuries of English rule almost stamped out the ancient Gaelic, or Irish, speech. The government has tried to revive the language by making its study compulsory in the schools. But practically all Irish



In early times, the island was divided into five kingdoms, or provinces, called the "Five Fifths" of Ireland. (Meath, the fifth province, is now a county.) The shaded portion is Northern Ireland.

AN IRISH FARMHOUSE AND ITS TINY FARMYARD



In County Donegal, in northwest Ireland, every farm has its flock of geese. The whitewashed farmhouse, roofed with thatch, opens directly into a small walled farmyard, called a *haggard*. The wall is built of sods. Ditches provide a runoff for the heavy rains.

authors write in English, and English is still the spoken language of almost all Irish people. Gaelic survives only in scattered areas on the west coast and in the western islands.

Education is compulsory up to the age of 14 and is given in free state schools. Religious orders (some of them Protestant) provide secondary education in private schools. Higher education is given at the University of Dublin and in branches of the National University of Ireland at Dublin, Cork, and Galway. The state supports technical schools and offers winter classes in agriculture for farmers.

THE IRISH FARMER'S "CAR"

The farmer's vehicle of all work is the two-wheeled cart, called a *jaunting car* or simply *car*. The seats are over the wheels. When sideboards are added, the car can carry small livestock or turf. This picture was taken near Skibbereen in County Cork.

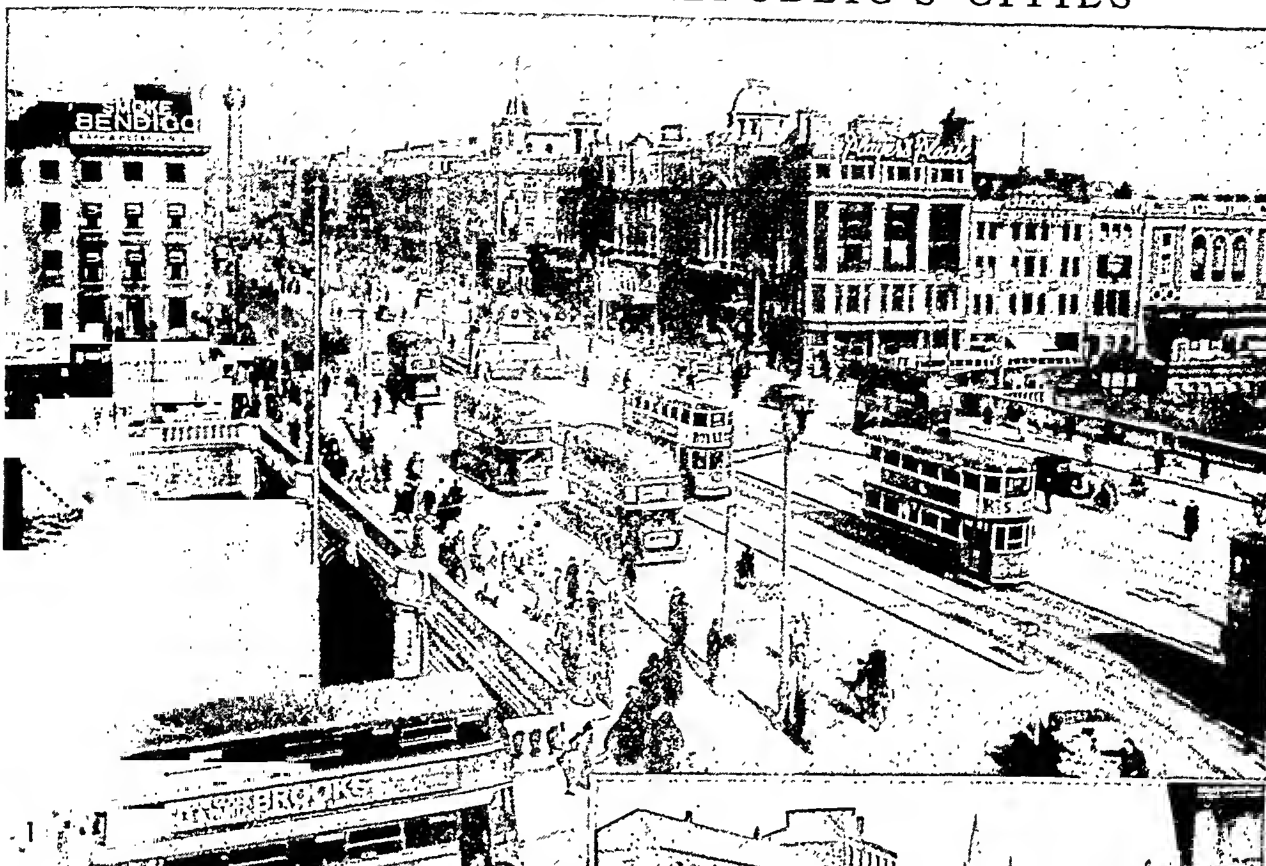
Irish Cities, Villages, and Farms

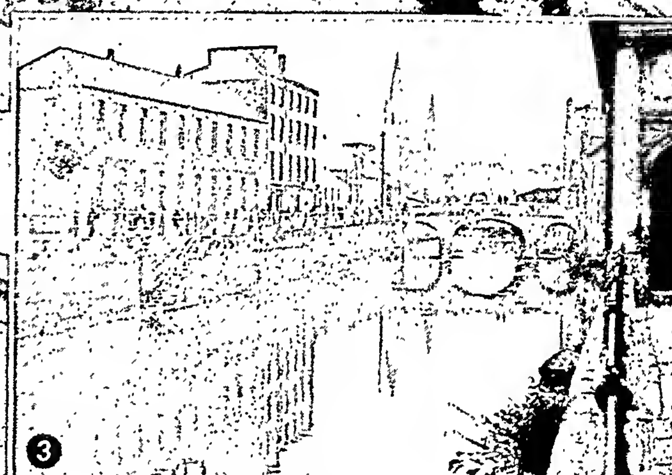
The principal cities are all seaports. By far the largest is Dublin, the capital, on the east coast (*see* Dublin). It shares Dublin Bay with the port of Dun Laoghaire (formerly Kingstown). The chief port on the south coast is Cork (*see* Cork). On the west coast are Limerick and Galway.

The typical inland town is little more than a market where farmers sell their produce. Almost every village has its pig fair. The larger centers have cattle or horse fairs. Every farmer knows the dates and places of all the fairs in his neighborhood.

Almost half the people live on farms. Except in the mountains and bogs, farmhouses are scattered evenly over the countryside. Most farms have less than 50 acres and are worked by the owner and his family.

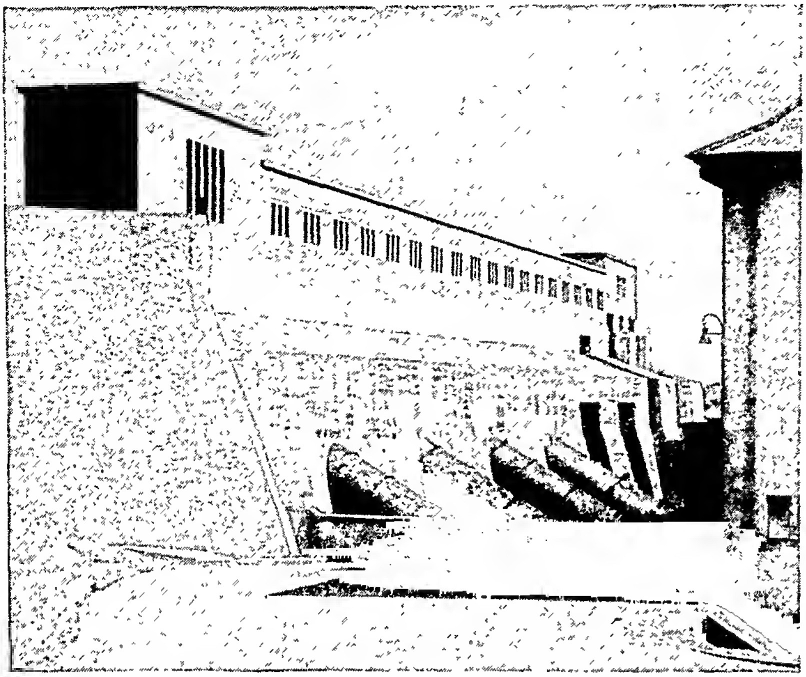
The newer Irish farmhouse has two stories. The old type is a boxlike cabin with thick whitewashed stone walls and a thatched roof. The largest room is the kitchen. Here is the hearth where cooking is done over an open turf fire and here the family eats. In the kitchen is a "dresser," or sideboard, filled with the family's best china. Here also is the shrine of the Blessed Lamp and the Sacred Heart picture, before which the family prays at night. Behind the hearth is the little-used "west room," which contains the family's heirlooms. Children sleep in the loft, or attic. Their parents have a bedroom.





1. Dublin lies on both banks of the River Liffey. This view is north from O'Connell Bridge along O'Connell Street to the Nelson pillar, 134 feet high. The pillar marks the center of the city. 2. The Abbey Theatre, in Dublin, became famous for its productions of Irish poetic dramas and peasant comedies. 3. The original site of Cork was in the vicinity of St. Finbar's Cathedral (shown here), on an island in the River Lee. 4. This is the older section of Limerick, on an island in the Shannon.

THE SHANNON RIVER SUPPLIES ELECTRICITY



The Shannon hydroelectric project helps solve the problem raised by lack of coal. It supplies electricity to run many factories and provides light and power for towns and farms as well. This picture shows the penstocks (19½ feet in diameter) which carry water from a concrete dam (left) down to the powerhouse.

Deep-sea fisheries supply herring and mackerel; shallow coastal waters yield shellfish.

Manufactures and Foreign Trade

Less than one-fifth of the working population is employed in factories. The chief industries are food processing. Coöperatives run the creameries, which produce butter, cheese, margarine, and condensed milk. Other food industries are brewing; grain milling and baking; bacon curing; and sugar refining (from home-grown beets). Next in importance are woolen textiles, clothing, and shoes.

Ireland lacks coal that is usable for industry. A large hydroelectric plant on the Shannon River, near Limerick, supplies power for factories and light for homes. Smaller developments on the Liffey and the Erne rivers serve Dublin and the northwest areas. Electricity is obtained also from peat-fuel generators. But Ireland must still import much coal from Britain to run its railways and factories.

The house opens directly into the farmyard, called a *haggard*. Here hens, geese, and ducks roam, and hay and turf are stored. Around the haggard are sheds for cattle and pigs.

The Irish describe a farm as "the place of (so many) cows," for the farmer's chief occupation is raising dairy cattle. His farm is divided into a *field* for grazing; a *meadow*, where grass is cut for hay; and a small *garden*. It may include also "a bit of bog," where turf is cut. In his garden, the farmer raises potatoes, cabbage, oats, beets, and turnips. Practically all he produces is eaten by the family and the farm animals. For money income he depends on his annual crop of calves and on milk, hogs, and poultry. Sheep are pastured in the uplands. The larger farms specialize in beef cattle or horses. Irish hunting and race horses are famous.

Potatoes have been the chief food of the farmers since they were introduced from America. They have a great advantage in the wet climate because they ripen underground. Wheat thrives only in the drier east. A considerable amount is imported.

Fishing is the main occupation in some of the west-coast villages and on the rocky islands off the coast.

Ireland's best customer is Great Britain, which buys its surplus beef cattle and hogs and its bacon, butter, milk, poultry, and eggs. Ireland imports wheat and stock feed, coal, tea, gasoline, sugar, and manufactured goods. Expenditures by tourists, chiefly from Britain and America, help to cut down Ireland's large trade deficit.

The government owns and operates the railroads, trucking, and canal shipping. World air lines use the Shannon Airport at Rineanna, on the Shannon River, 15 miles west of Limerick.

How Ireland Is Governed

The constitution of the republic was adopted in 1937. It provides for a president, elected every seven years; a cabinet, called "the government," headed by a prime minister; and a parliament. The parliament includes two houses: a house of representatives, called the *Dail Eireann*, and a 60-member senate, called the *Seanad Eireann*. The senate is made up of representatives of education, agriculture, labor, industry and public administration.

The constitution recognizes the special position of the Catholic church but guarantees complete freedom to other religions. It absolutely prohibits divorce.

Ireland's Long Struggle for Freedom

IRISH legends tell of many notable kings in the prehistoric period (*see* Irish Literature). The kings, or chieftains, warred constantly with one another; but they were nominally subject to a high king of the central district, the kingdom of Meath. His capital was at the ancient Hill of Tara.

The Romans conquered Britain but never ventured into Ireland. The island was spared also the Anglo-Saxon invasion, which reduced Britain almost to barbarism. During this period the Irish possessed one of the most advanced civilizations in western Europe. Their great epoch began when St. Patrick

began his mission (A.D. 432) and spread Christian teachings. For four centuries Irish missionaries and scholars continued his work—at home and on the continent of Europe (*see* Patrick, Saint).

Irish civilization was blighted near the end of the eighth century when the Northmen, or Danes, ravaged the coasts and plundered the rich monasteries and churches. The invasions lasted about 200 years. Before Ireland had recovered from them, its long struggle with England began. After the Norman Conquest in 1066, England came under the rule of a single strong monarch. In Ireland petty kings were still fighting one another over the issue of who should be high king.

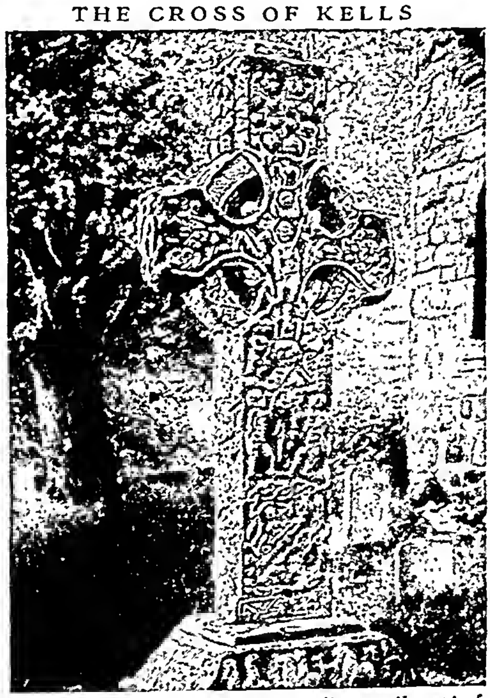
The English Conquer Ireland

The English conquest of Ireland began in 1169 in the reign of Henry II. Henry encouraged his Norman followers to seize portions of Ireland and hold them as fiefs of the English crown. The Normans intermarried with the Celtic population and their descendants (called Anglo-Irish) joined with the native Irish in warring against the English. English rule was limited to a small area around Dublin called "the Pale."

At the close of the 15th century Henry VII curbed the power of the Anglo-Irish lords and made the Irish parliament dependent on the king. In 1541 Henry VIII took the title of King of Ireland. He tried to bring the Reformation to Ireland and began to dissolve the monasteries. Queen Elizabeth I continued the suppression of monasteries and churches.

James I settled large numbers of English and Scots on "plantations" in Ulster (*see* Ireland, Northern). Ulster rebelled in 1641 and put to death thousands of Protestant settlers. The revolt spread to southern Ireland. In 1649 Cromwell landed at Dublin with his Puritan army and put down the rebellion with terrible cruelty. In 1654 he gave all the fertile lands east of the Shannon to his soldiers and drove the Irish westward to the bogs.

THE CROSS OF KELLS



This "high cross" in Kells, 40 miles northwest of Dublin, is one of some 45 still standing in Ireland. The crosses were erected by the early Irish Christians from the 10th to the 13th centuries.

James II relaxed the laws against Catholics. When he was driven from the throne, the Irish invited him to Ireland. William of Orange, who had succeeded James II to the throne of England, defeated the Irish under James, in the famous battle of the Boyne (1690). For a century and a half after this battle the "Orangemen" of Ulster held most of the power in Ireland. Catholics could not vote or hold office or even educate their children in the Catholic religion.

An uprising in 1798 was swiftly crushed by the British. William Pitt, the British prime minister, then proposed that Ireland give up its separate parliament and send members to the British parliament in London. He promised that if the Irish agreed, Irish Catholics would be given full political rights. The Act of Union (1800) went into effect on Jan. 1, 1801. But George III refused to enfranchise the Catholics.

The Struggle for Home Rule

In 1828 the popular Irish leader Daniel O'Connell was elected to the House of Commons. As a Catholic, he could not take his seat. Fearing a general rebellion in Ireland, Parliament in 1829 passed the Catholic Emancipation Act, giving Catholics the right to sit in Parliament. O'Connell then threw himself into the fight for repeal of the Act of Union. This movement was later called Home Rule.

In 1845, 1846, and 1847 a blight destroyed the potato crop in Ireland. Many thousands of people died of starvation or disease. A tremendous emigration began, to the United States and other lands. The population of the entire island dropped from about 8,000,000 in 1841 to only 5,000,000 in 1871.

William Gladstone, leader of Britain's Liberal party, put through Parliament the Irish Disestablishment Act (1869). This deprived the Established Church of Ireland (Protestant) of its position as a state church. Then Gladstone attacked the land problem. Agents of absentee English landlords rented small farms to Irish peasants at unreasonably high rents, called "rack rents," and evicted them at will. Gladstone's Irish Land Act of 1870 made it impossible to evict tenants except for nonpayment of rent. But the landlord could still raise the rent and evict the tenant if he could not pay it.

In 1879—a year of poor crops and falling prices—the Irish formed a Land League to help evicted tenants. The great Irish leader Charles Stewart Parnell became its president. The league advised tenants to refuse to work for landlords they considered unfair (*see* Parnell; Boycott). Gladstone's second Land Act (1881) reduced rents. But the real solution came later with a long series of Land Purchase acts. Under these the British government advanced money to enable tenants to buy their farms.

Gladstone's two efforts to put through a Home Rule bill for Ireland (1886 and 1893) ended in failure (*see* Gladstone). The Catholics in southern Ireland were determined to have Home Rule. But the Protestants of Ulster insisted on maintaining the Act of Union with Great Britain, and so were called Unionists.

Near the end of the 19th century a group of Irish writers formed the Gaelic League to stimulate a re-

birth of Irish language and culture (*see* Irish Literature). This national awakening called forth in 1900 a new political movement, Sinn Fein ("we ourselves"), led by Arthur Griffith.

In 1914 Parliament passed a Home Rule bill setting up a separate parliament for all Ireland. Ulster Unionists prepared to fight. Then the first World War broke out and the act was suspended.

The Easter Monday Rebellion

In 1916, on Easter Monday (April 24), a small force of armed Irish Volunteers seized important public buildings in Dublin. Patrick Pearse, leader of the Volunteers, stood on the steps of the General Post Office and read a proclamation announcing the birth of the Irish Republic. For nearly a week the rebels held out against the British. Finally, when much of O'Connell Street was ablaze, they surrendered.

The British arrested or deported hundreds of rebels and condemned to death 16 leaders, among them Pearse and Sir Roger Casement. Sir Roger was convicted of seeking German aid and was hanged for treason. Eamon de Valera, one of the leaders, escaped execution because he was American-born (*see* De Valera).

The executions undermined the moderate Irish Nationalist party, headed by John Redmond, and strengthened the Sinn Fein. Sinn Fein was not interested in Home Rule. It demanded complete independence from Britain for all Ireland. In 1918 it won 73 of the 105 Irish seats in the British Parliament. But instead of taking these seats, the Sinn Fein members established the *Dail Eireann* (Irish assembly) in Dublin in January 1919. De Valera, rescued from prison in February 1919, was elected president of the Dail.

The British sent in troops of ex-servicemen. The Irish called them Black and Tans because, lacking complete uniforms, they dressed partly in khaki and partly in dark clothes. The Irish secretly built up the Irish Republican Army (I.R.A.) and resisted the Black and Tans with savage guerrilla fighting.

In 1920 Lloyd George put through Parliament the Government of Ireland Act setting up separate parliaments for southern and northern Ireland. The Unionists of Ulster accepted the plan, and in May 1921 Northern Ireland began its separate existence (*see* Ireland, Northern).

Birth of the Irish Free State

Lloyd George then proposed a treaty giving southern Ireland dominion status. De Valera denounced the plan, insisting on complete independence. But other Sinn Fein leaders signed the treaty (Dec. 6, 1921) and the Dail accepted it. On Jan. 16, 1922, the Irish Free State came officially into existence as a dominion of the British Commonwealth.

The Dail formed a government with Michael Collins as prime minister and Arthur Griffith as president. De Valera and his Republican followers refused to take their seats in the Dail because this would have required an oath of allegiance to the English king.

De Valera's Irish Republican Army still roamed uncontrolled over the country. The Free State had no armed force. Griffith died in August 1922. Ten days later the I.R.A. shot down Collins. The Dail met, under guard, and elected William Cosgrave president. Cosgrave set up a strong police system, executed some rebels, and imprisoned De Valera for a year (1923–24).

In 1926 De Valera and his followers split off from the extreme Republicans of Sinn Fein and formed a new party, Fianna Fail (Soldiers of Destiny). In 1927 he returned with his group to the Dail and took the hated oath. In 1932 he again headed the government. He at once abolished the oath of allegiance to the king. He also withheld payments to Britain under the Land Purchase acts, which had enabled tenants to buy their land. Britain decided to make up the loss by imposing tariffs on Irish farm products. De Valera retaliated by raising tariffs on British coal and manufactured goods. The trade war lasted six years and all but ruined Irish farmers. In 1938 Britain accepted 10 million pounds in lieu of annuities, and each country agreed to reduce its tariffs.

A new constitution came into effect in 1937. It restored the ancient Gaelic name of Ireland, *Eire,* and declared Eire to be a sovereign independent state. It made no mention of the king or of the British Commonwealth.

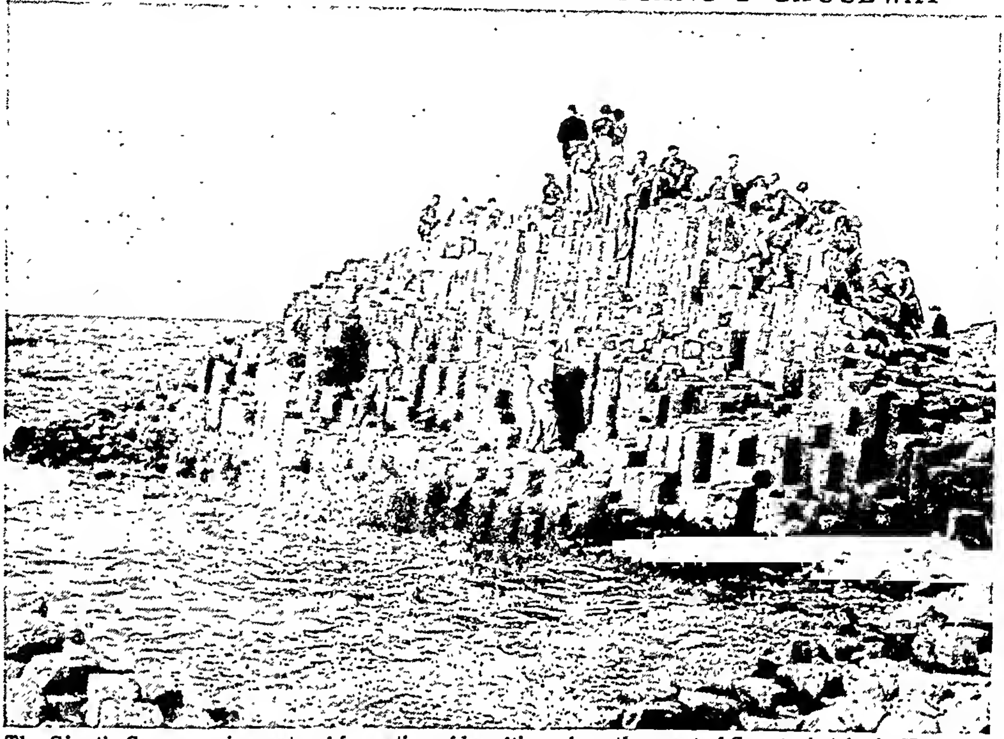
Eire was neutral throughout World War II. In 1948 John A. Costello became prime minister, succeeding De Valera, who had headed the government for 16 years. In November 1948 the British Parliament passed the Republic of Ireland Act, separating Eire from the British Commonwealth of Nations. The new Republic of Ireland was proclaimed on Easter Monday, April 18, 1949, to commemorate the Easter Monday Rebellion of 1916. In 1951 De Valera again became premier; he was succeeded by Costello in 1954. (*See also* Irish Literature; Ireland, Northern; British Isles; for maps, *see* British Isles; for Reference-Outline and Bibliography, *see* Great Britain.)

IRELAND, NORTHERN. Northern Ireland occupies the northeast corner of the island of Ireland. It covers only one-sixth of the total area of the island, but contains almost one-third of the population. Since 1920 it has been joined politically to Great Britain in the United Kingdom of Great Britain and Northern Ireland (*see* Great Britain). The rest of the island is occupied by the independent Republic of Ireland. (For map, *see* Ireland.)

Northern Ireland is sometimes called "Ulster" because it includes six of the nine counties that made up the early Irish kingdom, or province, of Ulster. The people of Ulster regard themselves as Irish; but they have closer ties with Scotland and England than with the Republic of Ireland. The southern Irish are predominantly Catholic. The northern Irish are descended in the main from Scottish and English settlers who came to Ulster in the 17th century. Two-thirds are Protestant (chiefly Presbyterians and Episcopalians). Southern Ireland has never given up its claim to the "Six Counties" it lost when Northern Ireland was separated from it. But "Ulster" prefers to remain in the United Kingdom.

The area of Northern Ireland (5,238 square miles) is little larger than Connecticut. The land is shaped like a saucer, rimmed by highlands. It is divided into the counties of Londonderry and Antrim in the north, Tyrone in the center, and Fermanagh, Armagh, and Down in the south. The Antrim Plateau rises in the northeast, the Sperrin Mountains in the northwest, and the Mourne Mountains in the southeast. The highest point is Slieve Donard (2,796 feet) in the Mourne Mountains, County Down.

CLIMBING THE STEPS OF THE GIANT'S CAUSEWAY



The Giant's Causeway is a natural formation of basaltic rock on the coast of County Antrim in Northern Ireland. The rock looks like iron, and it is divided into pillars, as often happens in basalt. Most are six-sided. A few have five or seven sides. They are all separate, but so close together a knife cannot be thrust between them. This is the Middle Causeway, between the Little and the Grand causeways.

Near the center lies the largest lake in the British Isles, Lough Neagh. The River Bann drains this lake to the north. County Fermanagh, in the southwest, contains the sister lakes of Erne, connected by the Erne River.

The seashores are rocky, but deep inlets (loughs) provide excellent harbors. On the north coast rises the striking natural formation called the Giant's Causeway—thousands of columns of basalt rock.

Manufacturing, Agriculture, and Government

Unlike the Republic of Ireland, Ulster is highly industrialized. Practically all the famous Irish linen is woven in Ulster (*see* Flax). Much of the flax is imported from Russia, Belgium, and northern France. Coal and iron are imported from Great Britain. Quarries in Northern Ireland supply basalt, granite, sandstone, limestone, chalk, and clay.

One-third of the people live in Belfast, the capital, a seaport on the east coast (*see* Belfast). Belfast has a large shipbuilding industry and manufactures textile and marine machinery, rope and twine, and cotton textiles. The second city in size is Londonderry ("Derry") in the north on the River Foyle.

The climate is cool and rainy. Very little land is forested. Cattle graze on the hills and in rich lowland meadows. Dairying is more important than farming. The best pastures and farmlands lie in the river valleys and on the lake shores. The peasants live in whitewashed thatched cottages in small villages. Many have only five or ten acres. They consider 40 acres a good-sized farm. They raise pigs and chickens and grow potatoes, hay, oats, and turnips. In moist regions they grow flax. Fishermen get salmon from the rivers and herring from the sea.

Northern Ireland elects members to the British House of Commons. The local government is at Stormont, near Belfast. It consists of a parliament (made up of a senate and a house of commons), a cabinet, and a prime minister. The chief executive officer is the governor, appointed by the British Crown.

Ulster's Stormy History

In ancient times Ulster was one of the five kingdoms, or provinces, of Ireland (*see* Ireland). Its boundary was then much farther south than it is today. Two princely families, the O'Neills and the O'Donnells, long challenged British rule. At last in 1607 Hugh O'Neill, Earl of Tyrone, fled from Ireland with scores of Irish chieftains. This "flight of the earls" marked the end of ancient Celtic Ulster.

Britain declared the earls guilty of treason and seized their great estates. Then James I sent Scottish and English colonists to settle "plantations" on the seized lands. Presbyterian and Episcopal churches appeared in a country that had been wholly Catholic. The Catholics rose against the Protestants in 1641, but they were crushed by Cromwell, and power remained with the Protestants thereafter.

In the 19th century the southern Irish began to clamor for Home Rule. Ulster "Unionists" clung to the union with Great Britain. In 1920 the Government of Ireland Act created Northern Ireland out of the six predominantly Protestant counties of Ulster. The other three counties joined the Irish Free State (now the Republic of Ireland). Fierce dissension rose in Ulster between the Catholic minority and the Protestant Unionists. The southern Irish almost

HARVESTING OATS IN NORTHERN IRELAND

These farmers are cutting oats on a small hillside field, using a simple horse-drawn cutter. The treetops show how steeply their land slopes down to the river. The road at the left follows the Foyle River to Londonderry, in the background.

brought on civil war by demanding Fermanagh and Tyrone counties and several border towns. In 1925 the dispute was settled in favor of Northern Ireland.

The second World War intensified the differences between north and south. Southern Ireland remained neutral. Northern Ireland supplied the only naval bases in Ireland for trans-Atlantic shipping. The United States arranged to establish an American base at Londonderry in June 1941, six months before it entered the war. The first American troops to reach Europe landed in Northern Ireland and about 300,000 trained there. Belfast turned out warships and freighters, aircraft, rope, and munitions. Population (1951 census, preliminary), 1,370,709. (For Reference-Outline and Bibliography, *see* Great Britain.)

IRIS. Because of their many colors the irises take their name from Iris, the Greek goddess of the rainbow. Architects and sculptors have used them as models since the days of ancient Egypt. In the 6th century iris preparations were recommended for removing freckles and curing ulcers. In the 12th century Louis VII adopted the fleur-de-lis, a conventionalized form of a wild European iris, as the emblem of the French royal house. A British physician of the 16th century wrote that iris broth used as a mouth wash would make loose teeth firm again. Today the fragrant orris root, obtained from the rhizomes (rootstocks) of certain species, is used as a base in dental powders, cosmetics, and perfumes. Irises are valued primarily, however, for their beauty and adaptability to landscape gardening. The colors include white, blue, lavender, purple, yellow, brown, pink, red, and mixed tints.

Irises grow wild in the north temperate zone in marshes and wet meadows. There are several hundred cultivated garden varieties. Most of them have been developed from the German or common blue iris and the Japanese bearded iris. Below the equator is a closely related genus *Moraea*. The bearded iris, a garden favorite, needs plenty of sunshine. It is easily cultivated in well-drained soil. Several species of the beardless iris are grown in garden pools. Members of the crested iris group are popular in rock gardens. The wild species are often called flags, because they wave in the breeze like banners. The iris is the state flower of Tennessee. (For illustration in color, *see* Gardens and Gardening.)

Family name, *Iridaceae;* genus *Iris*. Rhizomous species commonly grown in America: blue iris (*I. germanica*), bearded, stem about two feet long, sword-shaped leaves; *I. variegata*, bearded, 15-inch stem, yellow flowers; large blue flag (*I. versicolor*) and slender blue flag (*I. prismatica*), beardless, native to the United States; Japanese iris (developed from *I. kaempferi*), beardless, flowers range from white through purple, widely cultivated; crested dwarf iris (*I. cristata*), lilac-colored flowers, white crest (on sepal) tipped with orange. Bulbous species rare in this country: *I. xiphium*, a Spanish iris, short stem, variable color.

BEAUTY RIVALS—THE IRIS AND THE MOTH

For beauty and variety of form and coloring, the iris family is unmatched in the world of flowers save, perhaps, by the orchids. Irises might, indeed, be called the orchids of the north, for they are found throughout the temperate zones of North America and Europe. Among the handsomest of the family is the one shown on the next page in full bloom and color—a variety of the species called *Iris germanica*, the German garden iris.

Upon the stem of this flower the photographer placed for comparison a cocoon of *Samia cecropia* and the moth which comes from it. When it first crawled from its gray wrapping the cecropia's wings were crumpled as the petals inside a flower bud. Then the tiny pumping organs inside the moth's body forced blood into the wing veins, spreading and expanding them rapidly. Clinging to its support the cecropia fanned and dried its new-spread wings. Its long body—a relic of its caterpillar days—shortened, thickened, and grew firm; its feathery antennae straightened; its legs became strong and steady. We see it now ready for flight.

IRISH LITERATURE. While all western Europe was still a barbarian wilderness, Ireland already had a rich culture and an extensive body of literature in Gaelic, preserved by word of mouth. In the 5th century A.D., scribes began to put in writing

From a photograph by Lynwood M. Chace *Painting by Jean M. Eltwein*

BEAUTY RIVALS—THE IRIS AND THE MOTH

what was remembered of the ancient stories. These tales still keep alive the glorious history of Ireland, for many modern writers have retold them in English; and they form a valuable contribution to the folk-lore of the world (*see* Story-Telling).

Legend and Folk-Lore

These sagas fall into three main groups. The first, the Legendary Cycle, deals with a mythological world (perhaps 3300–1000 B.C.) peopled with the shadowy figures of the gods and demi-gods of the early Irish. Here we find the goddess Eire and the god Ir, from whom come the names Eireann (or Erin) and Ireland. Best known of the deities are Lugh the Long-Handed, the sun god, and Balor of the Evil Eye, god of darkness and death. The blond, godlike People of Dana (Tuatha de Danánn) finally disappear from earth and take up their abode inside the hills of Ireland as Sidhe ("shee," or fairies). But in later stories the gods come back to take part in the fortunes of men.

The second group, the Red Branch Cycle, tells of the Irish world of about the first century A.D. This world is inhabited by mighty warriors, beautiful women, and gifted poets. The poets, or story-tellers, were revered by all; even the heroes dreaded the barb of their satire and desired to do brave deeds that might win praise in a song. This cycle, sometimes called the Ultonian, treats especially of the wars between Connaught and Ulster, and the mightiest hero is Cuchulain, "The Hound of Ulster," most famous of all the warriors of Red Branch Hall. In the best known episode, 'Táin Bó Cúailgne' (The Cattle Raid of Cooley), when Queen Maeve of Connaught tries to seize the wondrous Dun Bull, Cuchulain for a time holds at bay the armies of three provinces. Other stories in the cycle tell of the tragedy of Deirdre, who for love defies her prophesied fate and brings death to her husband and his brothers, the sons of Usnach.

The Fenian Cycle, the third of the groups, pictures an Ireland of about 200 A.D. These tales were closer to the interests of the common people; and story-tellers kept adding to them even down to the 18th century. Today the name of Finn MacCool is still a household word in every part of Ireland. Fionn Maccumhail is leader of the Fianna ("militia") of Ireland. His grudge against the kingly house, whose champion has slain Fionn's father, is the main theme of the cycle. When the Fianna go down to defeat, Fionn's son Ossian, the bard, is almost the sole survivor. In a later cycle of stories, this hero returns to Ireland after spending 300 years in the Land of the Ever Young, and debates with St. Patrick over the relative merits of the pagan and Christian worlds.

Literature of Early Christian Times

The piety and learning which blossomed under St. Patrick in the 5th century turned Ireland into the "Island of Saints and Scholars" (*see* Hebrides Islands; Patrick, Saint). Students came from everywhere, fleeing from Europe's Dark Ages. A flood of manuscripts recorded the old stories and the new religious writings—saints' lives, books of hours. and the like. All but a handful of these manuscripts perished during the Danish invasions (795–1000 A.D.) or later. Fortunately, during the 11th and 12th centuries scribes copied or revised older manuscripts then existing, and much of their work survives. From then until the end of the 17th century, most of the new literature came from the bards (minstrels) rather than from the churchmen. It consisted mainly of laments, satires, annals, histories, and legendary genealogies.

English-Irish Literature

With the steady increase of English domination in Ireland, especially during the 18th century, most of the old great families died out or allied themselves with English culture. The native literature became oral again, living only in the memory of the people. The best known writers of that period—Jonathan Swift, Oliver Goldsmith, Richard Steele, Edmund Burke, Richard Brinsley Sheridan—belong properly to English literature (*see* English Literature). More truly Irish in subject and spirit are the novelist Maria Edgeworth, and the caricaturist writers Samuel Lover and Charles James Lever, with their tales of peasant life and country squires.

Poetry still lived, in English forms and language. Gay and tuneful rhymes sing in the 'Irish Melodies' of Thomas Moore and the poems of Francis Mahony ("Father Prout"). Deeper feeling, springing from sincere love of beauty and pride in race, marks the work of James Clarence Mangan, with his matchless translations and patriotic poems, and Sir Samuel Ferguson ('Lays of the Western Gael').

Irish Literary Revival

Late in the 19th century the Gaelic League began to collect and publish the remnants of the native folk literature. Side by side with this revival of the Gaelic tongue grew a literary movement of distinctively Irish writing in English. Although some modern writers—such as Oscar Wilde, George Moore, Bernard Shaw and Lord Dunsany—belong to English literature, present-day Irish literature owes its glory to those who felt the inspiration of the Irish Literary Revival. Stories of Erin's former greatness and her modern struggle for a life of her own stirred W. B. Yeats, Padraic Colum, Katharine Tynan, George W. Russell ("Æ"), and James Stephens. The greatest prestige came to the movement from the romantic tragedies and folk drama, written especially for Irish players, by the Abbey Theater group. Douglas Hyde, Yeats, Colum, Lady Gregory, Sean O'Casey, St. John Ervine, and Lennox Robinson were members of this group. Foremost of all was John M. Synge, master of both comedy and tragedy. He knew the heart of the Irish peasant, and portrayed with faithful realism and rich dialogue the baffling mixture of traits found in the Gaelic character.

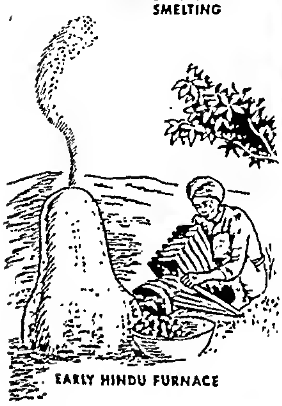
The Irish Language

This language, known as Irish Gaelic, is a sister tongue of Scotch Gaelic and Manx, and belongs to the Celtic branch of the Indo-European family (*see* Language and Literature). It is highly inflected. Its nearest relatives are the so-called "Brythonic" languages, including Welsh, Cornish, and Breton.

IRON *and* STEEL—*Our Most* USEFUL *Metals*

ANCIENT IRONMAKER

EGYPTIAN SMELTING



EARLY HINDU FURNACE

In the hot glare given off by molten iron, a workman signals directions to a crane operator (out of sight above). The operator controls the great crane's hooks as they lift and tilt a ladle to pour melted iron into an open-hearth furnace. The furnace already has melted scrap metals and limestone. The other workman is about to throw in another scoopful of limestone. The melted limestone draws impurities from the metal and forms slag. In about 12 hours the iron will become steel.

IRON AND STEEL. The metals iron and steel serve men in thousands of different ways. They are the most useful metals because they can be made hard to resist repeated heavy blows, strong to support great weights, or tough to withstand powerful twists and pulls. Steel can hold a razor-sharp edge for cutting. And when softened or melted by great heat, these metals can be formed into any desired shape.

From them men make almost all their tools from the mechanic's simple hammers, saws, and wrenches to industry's complicated machine tools: cranes, steam shovels, lathes, and textile looms. Even the watchmaker's tiny tweezers, the dentist's fine drills, and the surgeon's delicate scalpel are made of steel.

In construction trades, builders erect a framework of steel to hold up a skyscraper's great weight of stone, brick, and glass. Even a small house has some four tons of iron and steel in the form of nails, screws, hinges, window-sash weights, bathtubs, sinks, pipes, and furnace or boiler.

Railroads and other means of transportation depend heavily on iron and steel. Locomotives, cars, tracks, and bridges are made almost wholly from them. So are a ship's plates and the great engines that drive it through the sea. An airplane has many steel parts; and about 85 per cent of an automobile's weight consists of iron and steel. Electric light and power and electric communication equipment need magnetized iron and steel. Magnets in electric generators and motors and in telephones, telegraph instruments, and radio and television sets help to make them work.

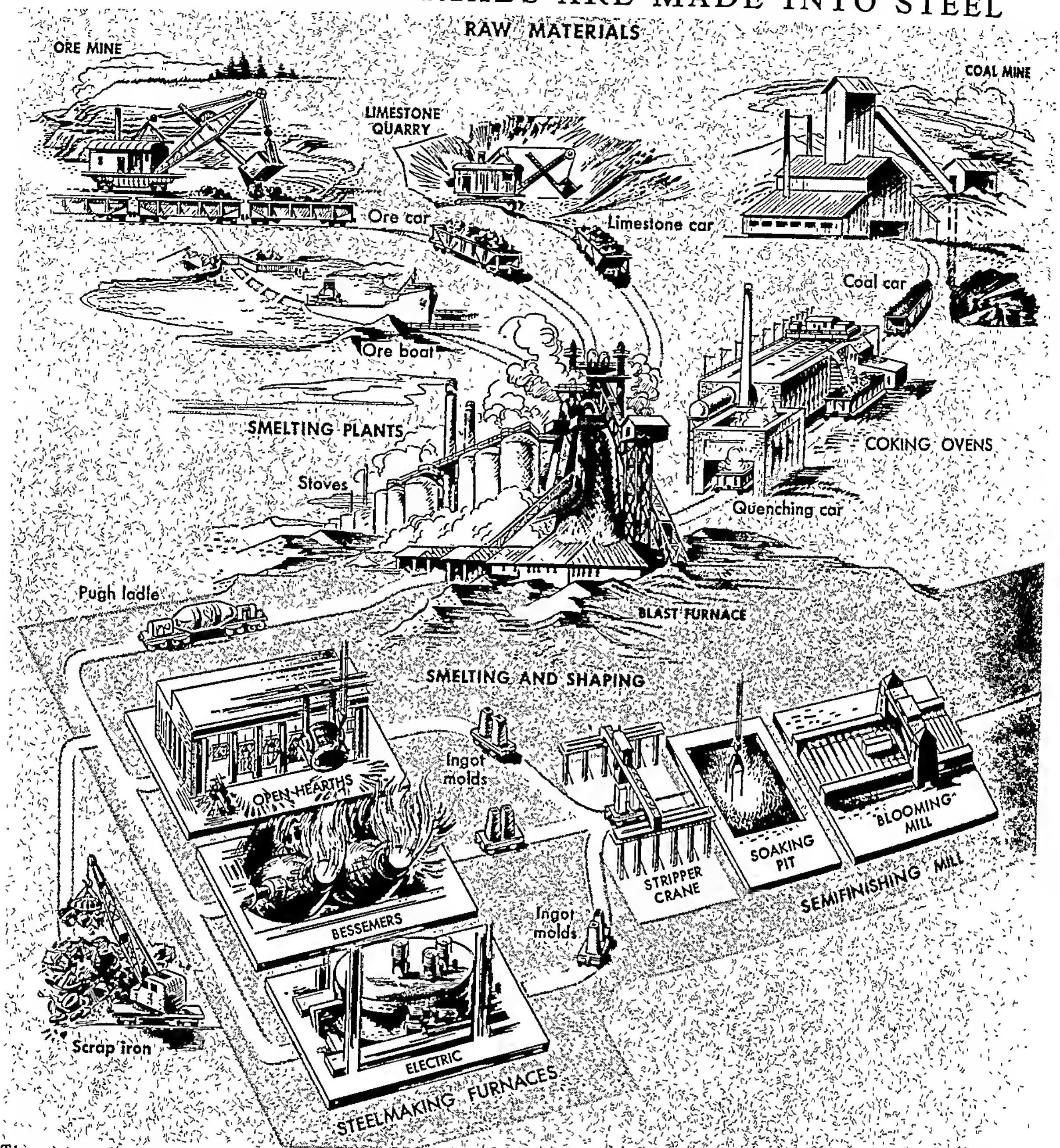
The Iron and Steel Industry

The iron and steel industry produces these metals cheaply because it works on a huge scale. Just one of its great mills covers hundreds of acres. On these rise huge piles of raw materials, tall furnaces, and chimneys that belch flame and smoke. Here big cranes lift weights of many tons, and Diesel locomotives shuttle loaded cars from one great building to another.

Iron- and steelmaking begins with the transporting of the necessary raw materials to the mill. The principal materials are iron ore, coke, and limestone. These are cooked in a tall furnace to make iron. Some iron is made directly into usable objects such as sinks and bathtubs. But most of it is reheated in other furnaces to make steel.

White-hot steel can be squeezed or hammered into many shapes. Some of these, such as pipes, beams, and rails, are used as formed in the steel mill. Others are sold to manufacturers of steel products to be used in automobiles, tin cans, machinery, bicycles, cooking pots, and thousands of other articles.

HOW RAW MATERIALS ARE MADE INTO STEEL



This picture diagram shows the principal steps in making iron and steel products. At the top of this page, raw materials (coke, limestone, and ore) are *charged* (fed) into a blast furnace. There the ore is smelted into molten iron. The hot iron may be cooled into shapes called "pigs." Some pigs are remelted to make iron articles; others are further refined into *malleable* and *wrought* iron. Most of the molten iron is carried in thermoslike Pugh ladles to steel furnaces. Three kinds of furnaces are used to make the many different kinds of steel. The steel is cooled into *ingots*, and the ingots are changed to other

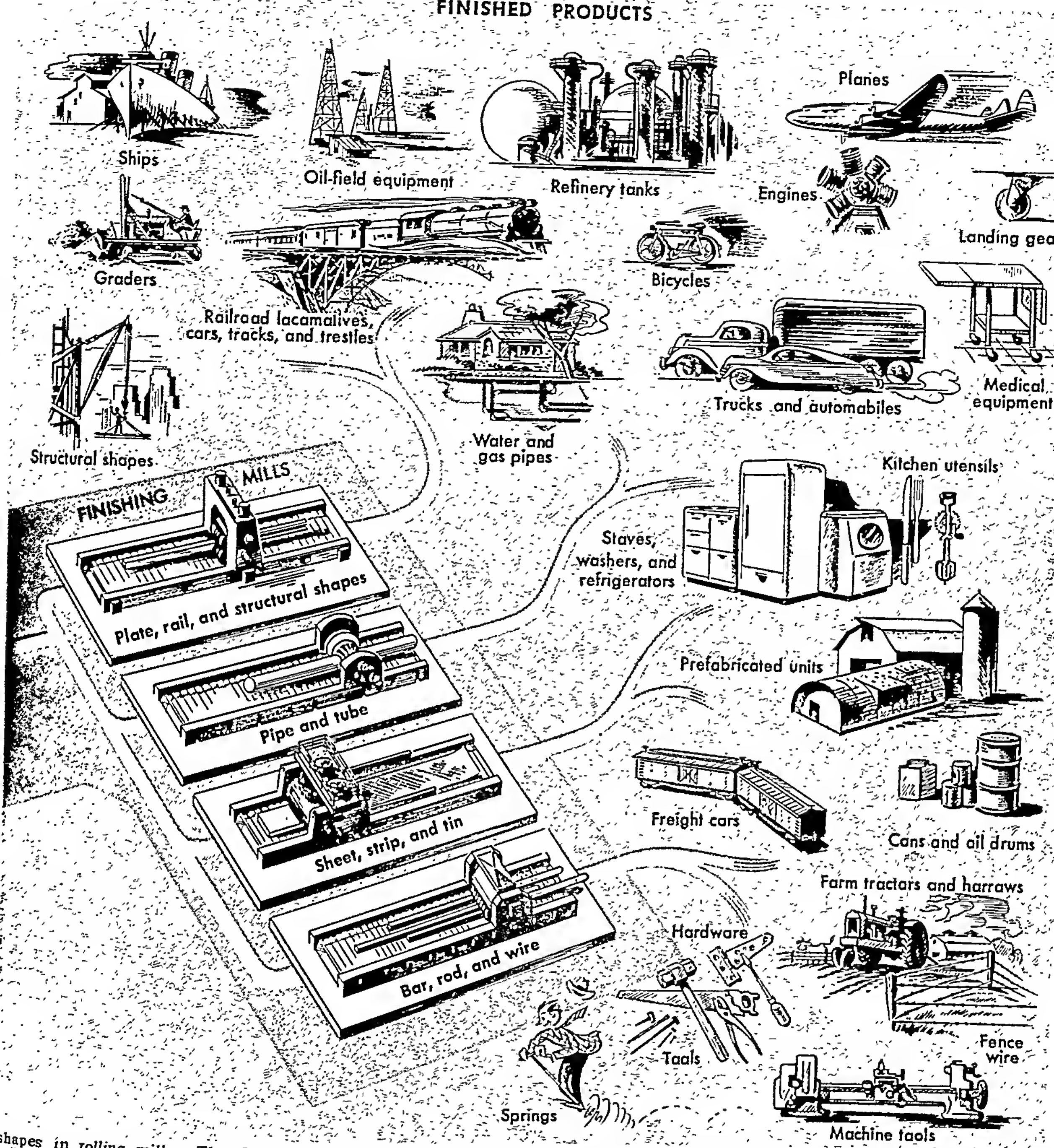
The Raw Materials for Iron and Steel

STEELMEN make iron and steel by using *iron ore, limestone, coal, air,* and *water*. Limestone is crushed and coal is baked into coke before being used to make iron (*see* Coke; Limestone).

These raw materials are plentiful, but they are bulky and heavy. Ore deposits usually lie far from coal mines and limestone quarries. Therefore iron and steel mills are commonly built where all the materials can be brought together most cheaply. As a rule it is cheaper to ship iron ore than coal and limestone, which are heavier.

Pittsburgh, Chicago, and Youngstown, Ohio, are great steel centers for this reason. These cities are also in thickly populated regions, and finished products can reach millions of customers by short hauls. In addition to mills for producing metals from ores, these centers also have many plants for manu-

FINAL SHAPING AND FINISHED PRODUCTS



shapes in *rolling* mills. The first changes are made in *semifinishing* mills, and the rest in *finishing* mills. The finishing mills form some of the steel into such shapes as railroad rails, girders, and beams. These are finished products and are ready for use. Other forms are sheets, strips, and rods. These are used to make other products. Usually all these operations, from blast furnace through finishing mill, are conducted in one huge plant. Finally, factories throughout the country buy the finished steel. They cut, form, and fasten the steel into thousands of different products. A few of these products are shown on this page.

facturing products from metal shapes. This saves the cost of shipping iron and steel elsewhere.

What Is Iron Ore?

Iron is a chemical element, but it is never found in pure form. Iron and other elements combine and mix with *gangue* (rock and other wastes) to form iron ore. The ores most used in iron manufacture are the *iron oxides* (combinations of iron and oxygen). The iron oxide called *hematite* is the most plentiful ore. Iron and steel also are made of iron oxides called *magnetite* and *limonite*. Deposits of magnetite, an ore with magnetic properties, are found with instruments which respond to the ore's magnetism. Geologists learn the extent and value of hematite and limonite deposits by drilling sample holes. (*See also* Minerals.)

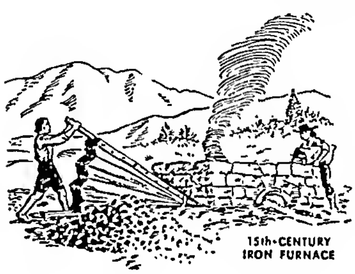
Ores in the United States and Canada

The principal ore deposits of the United States lie near Lake Superior. The area includes upper Michigan,

Wisconsin, and the Mesabi region of northern Minnesota. The nation's second largest deposits lie near Birmingham, Ala. The Birmingham ores are not rich, but ironmakers can use them profitably because coal and limestone are nearby. Smaller producing areas are found in New York, Pennsylvania, New Mexico, Utah, Wyoming, and California. In Canada, the search for new ores has uncovered large deposits in Labrador and Quebec. Another source of supply was found in Ontario, north of the Mesabi Range in Minnesota.

The large-scale production of steel in the United States has used vast quantities of the nation's easily worked ore supplies. The industry has searched widely for new deposits and has tried to find ways to use profitably billions of tons of available poor ores.

The inferior ores of the Lake Superior region contain about 25 per cent iron. They are found thinly distributed through very hard rock like that found in the Taconic Mountains in western New England and New York. Hence these poor magnetite and hematite ores are called *taconites*. They must be crushed, cleaned, and concentrated before they can be used. Any process for enriching ore is called *beneficiating*. Owing to its magnetic property, magnetite is more easily beneficiated than hematite (*see* Metals).


15th-CENTURY IRON FURNACE

Chief Foreign Deposits

The richest find in many years was made in Venezuela after the second World War. A mountain called Cerro Bolívar contains millions of tons of high-grade ore. Other deposits are worked in South America and the Caribbean islands. Europe has large deposits in northeastern France, Luxemburg, and Western Germany. Britain supplements her own small supply with imports from rich deposits in Sweden and West Africa. African deposits are huge, but as yet few are being worked. An American company mines ore in Liberia.

Russia has large deposits in both Europe and Asia. Asian deposits in India, Manchuria, and Korea are mined. In the Pacific area, deposits are worked in Japan, the Philippines, the United States of Indonesia, and Australia.

How Iron Is Made

IRON IS *smelted* (refined or reduced) from iron ore in tall cylindrical *blast furnaces* like the two shown on the next page. The blast furnace is fed with iron ore, coke, and limestone from the top. Inside, a roaring fire burns. The ore gradually melts and flows downward. Impurities are separated by the heat and the actions of gases and limestone. At the bottom, the

IRON MINES ARE OFTEN HUGE OPEN PITS

This picture shows an open-pit mine in the Mesabi Range of the Lake Superior region. To start such a mine, great power shovels strip a cover of sand, gravel, and rock from above the ore deposit. The ore extends downward several hundred feet. As the shovels dig down into it, the sides of the mine become too steep for rail cars. Then the ore is taken to the mine top by trucks or conveyer belts. At the top, the ore is loaded into rail cars and hauled to a lake port. It is dumped into the elevated bins of an ore dock. A boat is loaded through chutes reaching down from the bins into the boat's hold.

white-hot liquid iron and melted impurities are drawn off from time to time.

A blast furnace holds the equivalent of about 40 freight carloads. To keep it supplied, a crew of three men loads raw materials into skip cars and sends them to the top of the furnace. There they are dumped. To make one ton of iron, the blast furnace needs two tons of ore, one ton of coke, one-half ton of limestone, and a blast of three and a half tons of heated air.

Inside, the air blast causes the coke to burn at very high temperatures. The temperature inside the top of the furnace is about 400° F.; near the bottom it is 3,000° or more. The carbon monoxide gas given off by the burning coke streams up through the raw materials and *reduces* (attracts oxygen from) the ore as the ore sinks down. About midway down, the ore becomes a spongy mass of iron and impurities. At the bottom, the iron melts and trickles down through the white-hot coke into the hearth pool.

Flux and Slag

The limestone in the furnace *fluxes* (purifies) the iron in two ways. First, it aids some of the impurities to *fuse* (melt). Second, it combines with some of the melted impurities from the iron to form *slag*. The flux begins to melt below the halfway point in the furnace. Since the slag is lighter than iron it floats on top of the melted iron.

There are different kinds of slag because ores have different kinds of impurities to give up. Whether a slag is useful or a waste depends upon its impurities. Some slags are used as railroad ballast and road fill, in place of gravel in concrete, as an ingredient of cement, as insulating materials, as fertilizers, and as raw material for bricks.

How Workers Draw Off the Iron

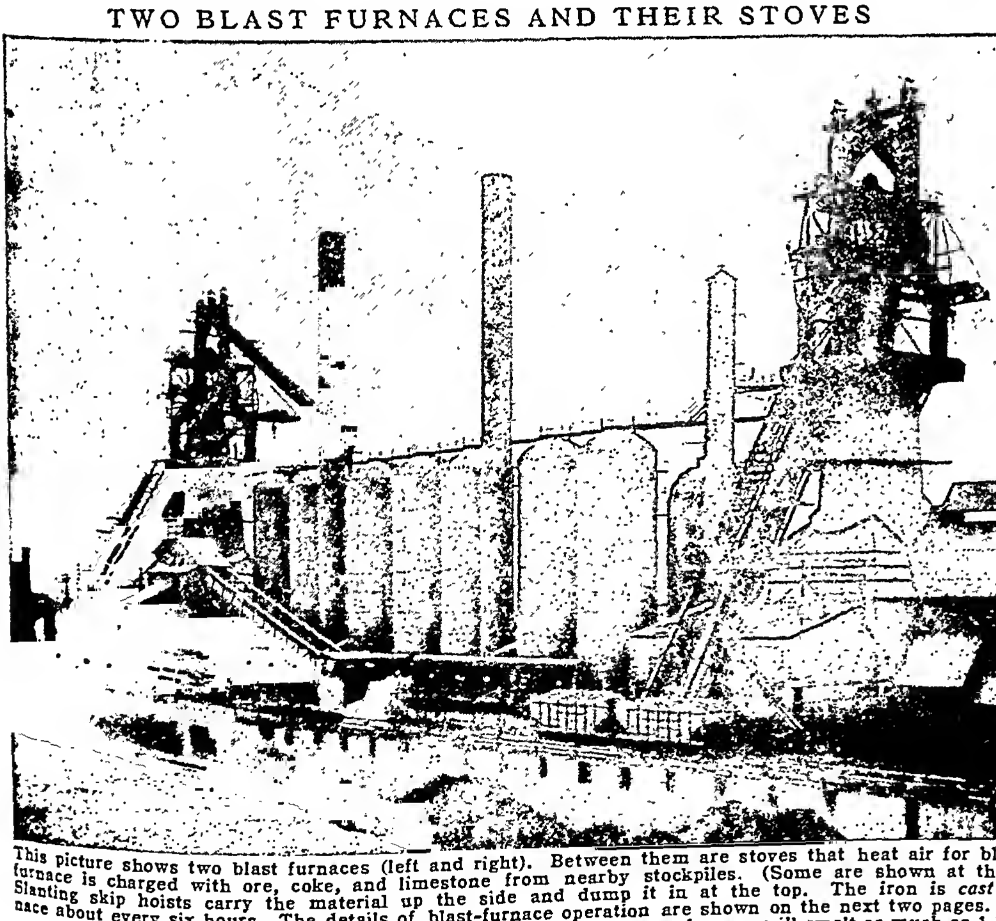
Big mills operate several blast furnaces under a *general foreman*. A *blower* oversees the workers of two furnaces and decides the pressures under which air is blasted into the furnaces. A *keeper* bosses a four-man crew at the furnace bottom.

About every six hours, the keeper drills out a clay plug that stops an opening called the *iron notch* at the base of the hearth, to draw off molten iron and slag. After this is done, the keeper plugs the notch with fresh clay shot from a big air-pressure gun. His crew maintains facilities for handling the molten iron. These include devices for skimming slag from the iron and clay-lined *runners* which take molten iron and slag to their destinations.

Casting begins when white-hot iron, giving off sparks and light, starts pouring from the iron notch. From the end of the runner, molten iron drops into an iron ladle below the casting platform. There are two types of iron ladles: a pot used for pouring iron into molds and a thermoslike tank car called a Pugh ladle. This is used to keep the iron hot and liquid.

Most of the iron is used to make steel but some may be cooled into molds as *pig iron*. The name comes from early ironmaking,

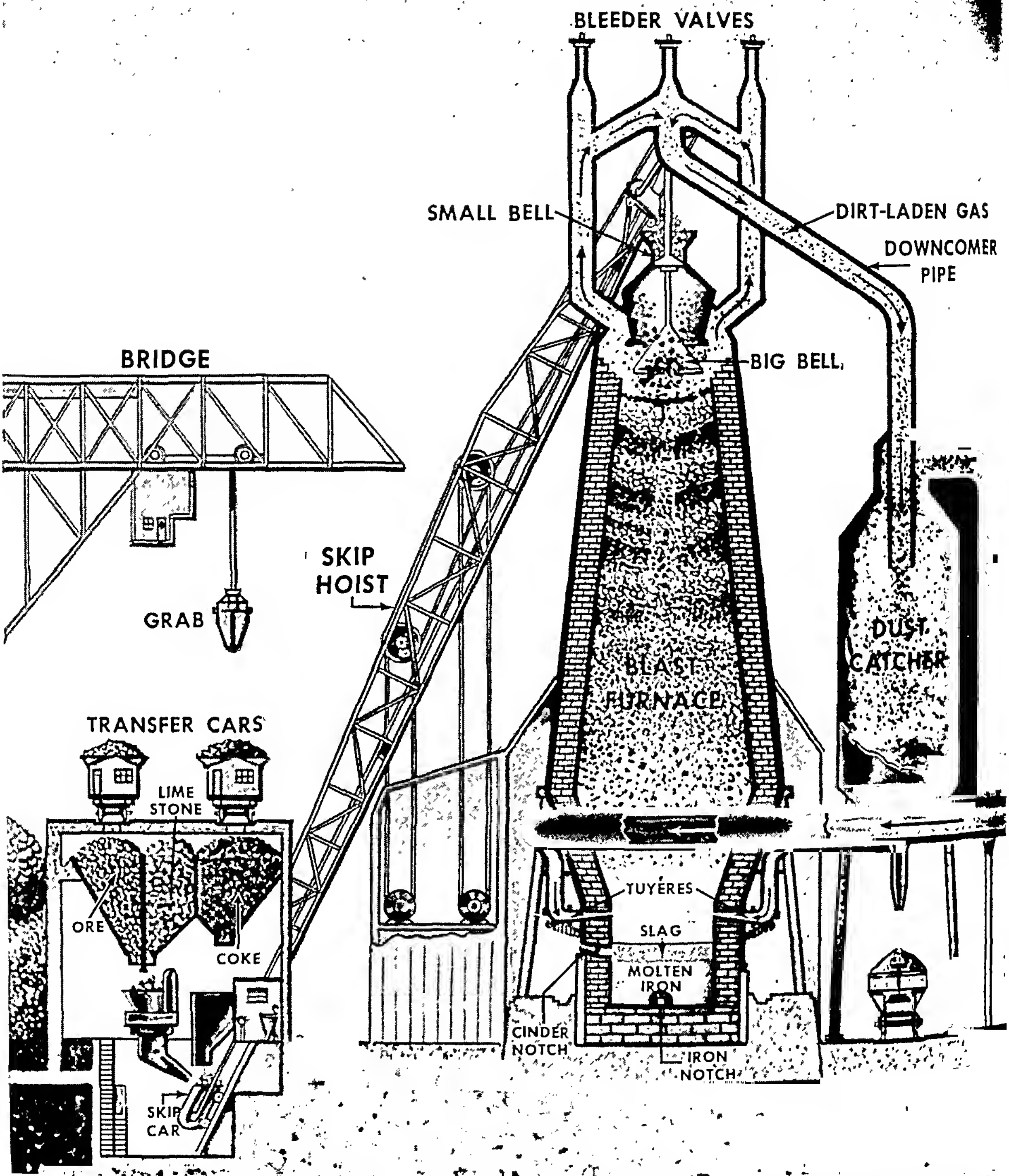
TWO BLAST FURNACES AND THEIR STOVES



COLONIAL IRON FURNACE

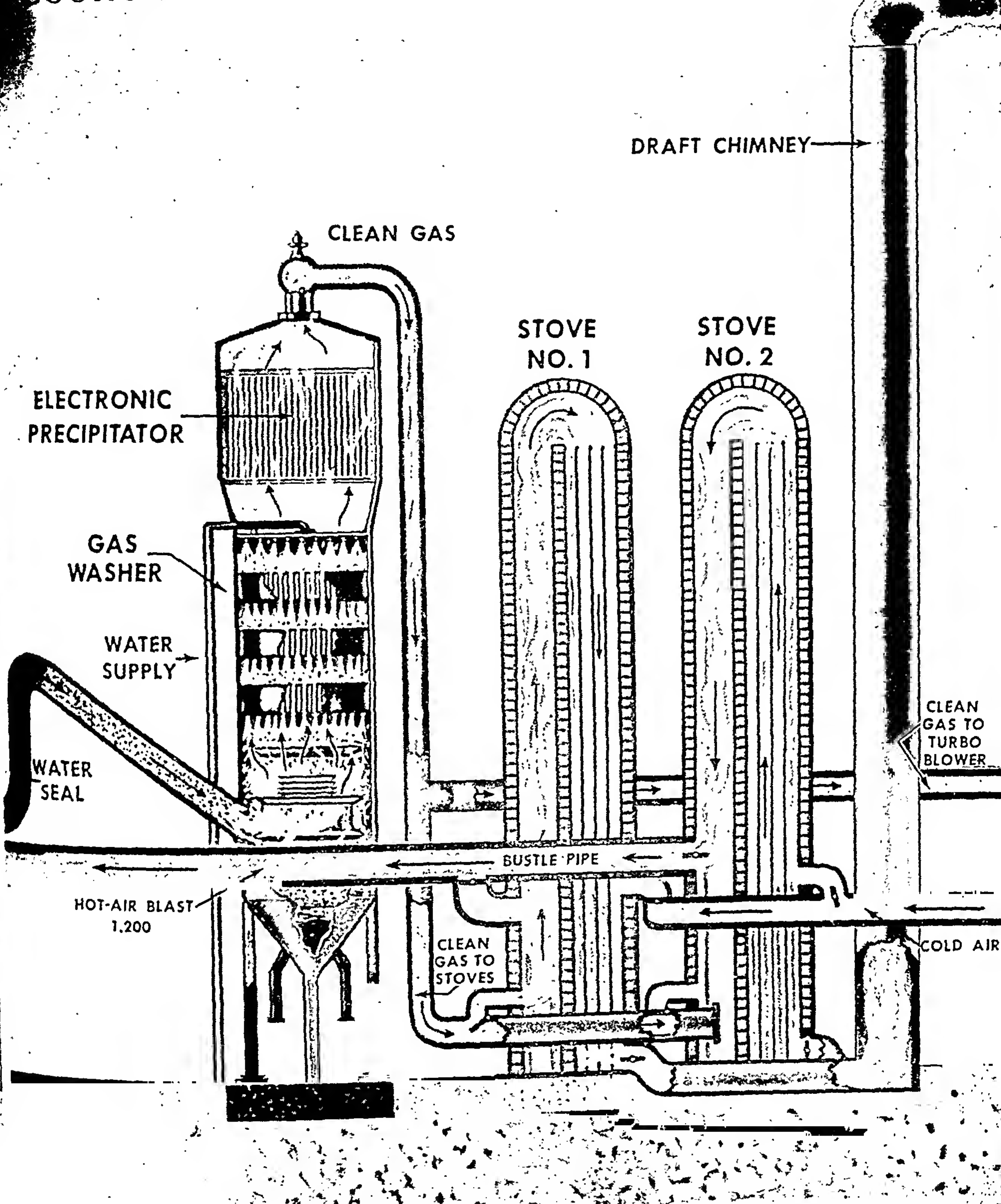
This picture shows two blast furnaces (left and right). Between them are stoves that heat air for blasting into the fire. Each furnace is charged with ore, coke, and limestone from nearby stockpiles. (Some are shown at the bottom of the picture.) Slanting skip hoists carry the material up the side and dump it in at the top. The iron is *cast* (drawn off) from the furnace about every six hours. The details of blast-furnace operation are shown on the next two pages. Blast furnaces smelt iron 24 hours a day, year after year. In a 24-hour period, a large furnace will smelt as much as 1,500 tons of iron.

HOW THE MIGHTY BLAST FURNAC



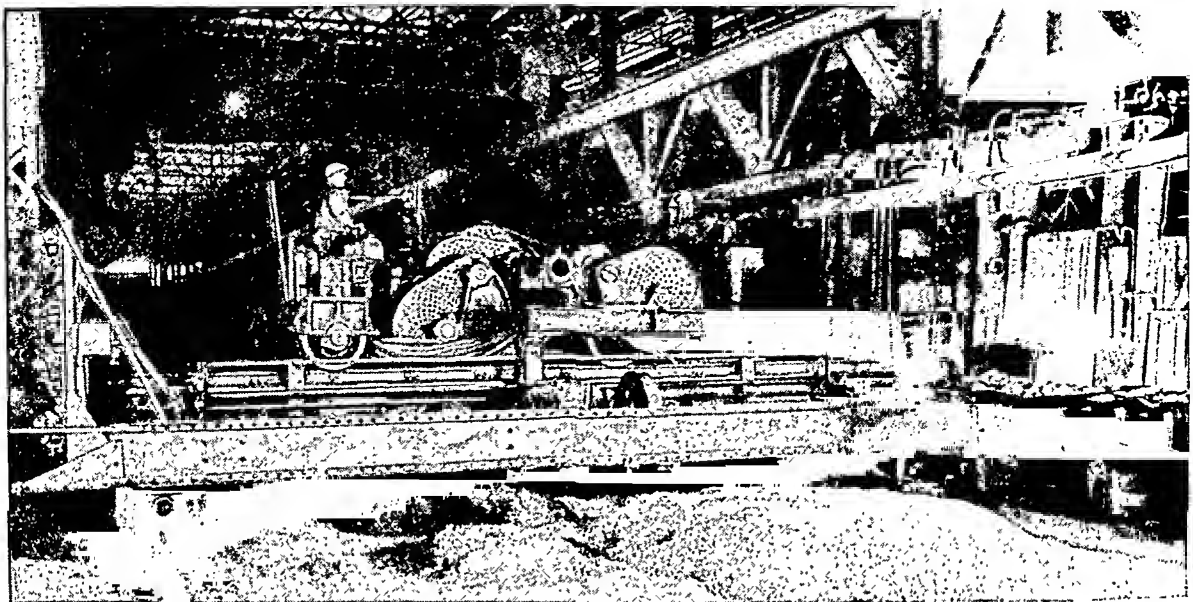
This picture shows how the blast furnace works continuously to melt iron out of iron ore. (All details here have been simplified; an actual blast furnace is shown on a preceding page.) At the left, a *grab* that rides on a *bridge* takes ore, limestone, and coke from stock piles and fills the *transfer cars*. These cars then fill the bins, which measure out accurate loads into the *skip cars*. A load of mixed limestone and ore alternates with a load of coke. The skip cars dump their contents into a hopper at the top of the furnace. The *small bell*, a cone-shaped valve, lowers to receive each load. Then it is raised to prevent the escape of hot gas, and the *big bell* is released to drop the load into the furnace. The hopper revolves continuously to spread the loads evenly. Meanwhile a constant blast of hot air pours in at the bottom and helps burn the coke. This keeps a roaring fire running through the furnace. The fire melts the iron out of the ore, and the limestone combines with impurities in the ore to form *slag*. The molten iron drains to the bottom of the furnace, and the lighter slag floats on top of it. From time to time, slag is drawn out through the *cinder notch* and iron is drawn out through the *iron notch*. All the rest of the mechanism

COOKS IRON OUT OF RAW IRON ORE



exists to utilize the hot furnace gas. Hot, unburned gas passes from the top of the furnace through *downcomer pipes*. (Only one is shown here.) The dirt-laden gas passes through a *dust catcher*, a *gas washer*, and an *electronic precipitator*. It emerges clean and ready for burning. Part of it is used to heat the brick-lined stoves at the right. (There are usually several stoves; only two are shown here.) *Stove No. 1* is being heated by the gas set afire at the bottom of the stove. It passes through the brick flues, then out the chimney. *Stove No. 2* has been heated previously and is now heating fresh air for the furnace. To supply the air, *turboblowers* are used. They are driven by clean furnace gas. The blowers bring cold, fresh air into the hot stove. The air passes through the stove, as shown by the arrows, picking up heat as it goes. Backed by pressure from the blowers, it emerges as a hot blast (1,200° F.), into the *bustle pipe* which circles the furnace. From the pipe it sprays into the furnace through nozzles called *tuyeres* (pronounced "tweers"). Only two are shown here. When stove No. 2 cools off, dampers are set to reheat it. At the same time cold air to be heated for the blast is sent through another stove on the line.

CHARGING THE OPEN-HEARTH FURNACE



Here a charging machine stands in front of an open-hearth furnace. The machine's great arm thrusts steel boxes loaded with iron and steel scrap metals, limestone, and iron ore into the furnace, and dumps them by turning them upside down. After this solid charge has melted, molten iron is poured into the furnace, as shown in the first picture in this article.

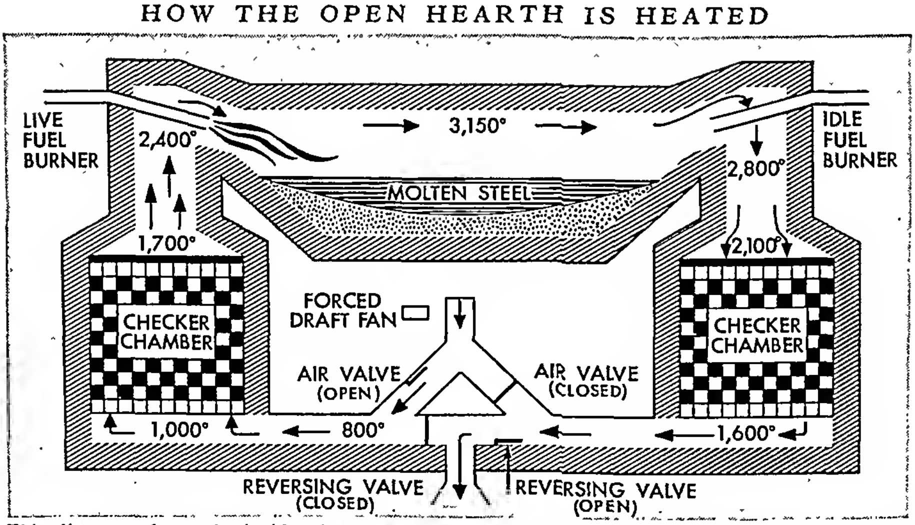
when the molds which received iron from a central runner resembled piglets suckling a sow. Some pig iron is remelted and cast in molds to form various articles; it is then called *cast iron.*

Pig iron and cast iron are hard and brittle. Pig iron picks up from 3 to 4.5 per cent carbon from burning coke when iron is smelted from ore in the blast furnace. Its use is limited to castings. Wrought iron can be made from pig iron by reheating, stirring, and squeezing and beating, and it can be shaped by hammering or rolling. Wrought iron is tough but soft. For most modern uses, steel is preferred.

How Steel Is Made

THE WORD "steel" means metal refined from pig iron and then alloyed with various other chemical elements. Steels can be divided into two main grades: *plain steels* and *alloy steels.* Plain steels contain three principal elements—iron, carbon, and manganese. Neither the carbon nor the manganese totals more than 1.50 per cent of the metal. Plain steels, with 0.10 to 1.50 per cent of carbon, are classified as *low-*, *medium-*, and *high-carbon* steels. Alloy steels are made of plain steels by adding enough of one or more other elements such as nickel, chromium, or molybdenum to change the character of the metal (*see* Alloys). Steels are made in a *Bessemer converter* or in *electric* and *open-hearth furnaces.*

HOW THE OPEN HEARTH IS HEATED



This diagram shows the inside of an open-hearth furnace. It was given this name because the charge melts on a hearth open to the sweep of flames. Below the hearth a fan drives air through heated bricks laid in a checkered pattern (*checker chamber*). Above the chamber, the heated air and fuel combine and burn in a great sweep of flame over the molten steel. The burned gases pass out through the opposite checker chamber, reheating its bricks, and then escape to the open air. Notice the various temperatures along the air path. About every 15 minutes the flow of fuel and air is reversed to draw air through the newly heated checker chamber and to reheat the other chamber.

How Steel Is Made in an Open Hearth

Open-hearth furnaces stand in a long row under a high roof. The furnaces' tall chimneys rise above the roof. On the *charging* (loading) side of the furnaces, from just below the furnace doors, extends a wide floor. The *charging machine* moves along this floor on widely spaced rails. Powerful electric cranes rumble overhead both on the charging and on the *tapping* (draining) sides of the furnaces.

On the tapping side, a *tapping platform* is attached to the furnaces at about the same height as the charging floor. About 20 feet lower is a natural earth floor. Against the wall opposite the furnaces extends the *pouring platform,* and in front of this lie rail tracks.

To make a *heat* (one batch of steel), the *first helper* (boss of one furnace) directs a charging-machine operator to dump flux (limestone), iron ore, and iron and steel scrap into his furnace. These are heated about two hours, until they begin to fuse. Then the furnace is charged with many tons of molten pig iron (called *hot metal* when used for making steel). Other fluxing materials are added later. A heat is refined into steel in from eight to twelve hours.

During this time, oxygen released from the ore combines with carbon in the hot metal to form carbon gases. These, along with the burned fuel, are used to heat incoming air. The alternate heating of brick chambers is called the *regenerative* principle. The flux melts and combines with impurities to form slag. A *melter* (foreman of six or seven furnaces) supervises all operations. A first helper and his two assistants tap the furnace.

How Steel Is Made in a Bessemer Converter

A Bessemer converter is a huge pear-shaped pot. It rests on axles and its open top can be tilted one way to take a charge and the other to pour out finished steel. Converters hold from 5 to 45 tons.

After the converter is charged with hot metal, it is swung to the upright position. Air blown through holes in its bottom at the rate of 20,000 cubic feet a minute passes through the hot metal. Sparks and thick, brown smoke pour from the converter's mouth as the oxygen in the blow combines with some iron and with silicon and manganese to form slag. Then 30-foot flames replace the smoke as the oxygen combines with carbon and burns. The whole process takes less than 15 minutes.

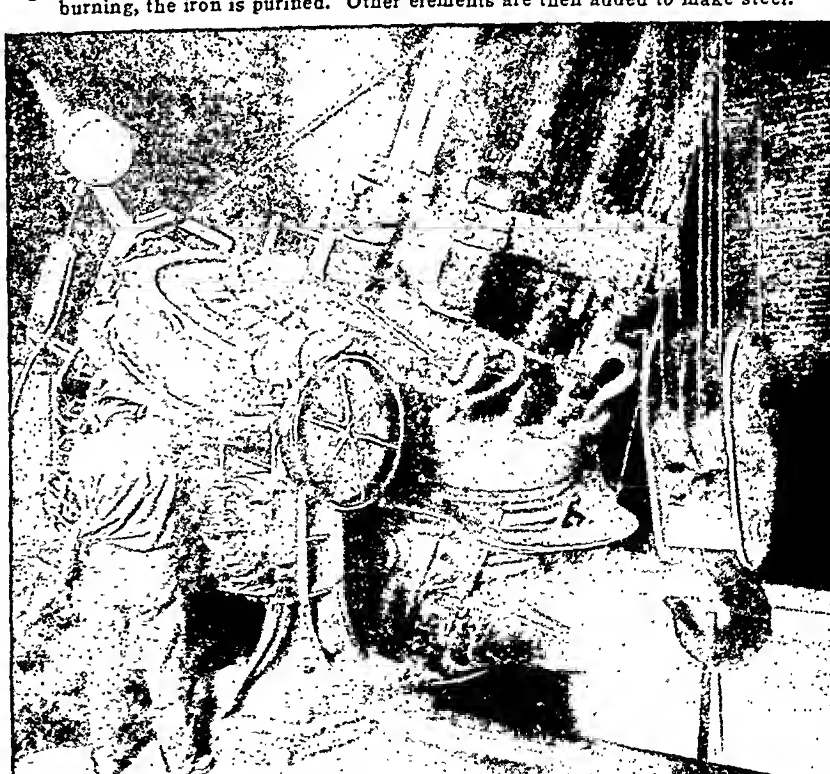
The blow eliminates desirable elements such as carbon and manganese along with undesired elements. After the blow the needed elements are restored to bring the metal to the desired composition. Usually this is done by adding *spiegeleisen,* an alloy of iron, manganese, and carbon made in a blast furnace.

How Steel Is Made in the Electric Furnace

Expensive, high-quality grades of carbon and alloy steels (such as stainless, tool, and corrosion- and

BESSEMER CONVERTERS AND AN ELECTRIC FURNACE

Molten iron is charged into the Bessemer converter at the left. The upright one is purifying iron. A blast of air through holes in the bottom provides oxygen for burning unwanted carbon and other impurities from the iron. After about 15 minutes of burning, the iron is purified. Other elements are then added to make steel.



The best alloy steels are made in accurately controlled electric furnaces. Scrap is melted by a hot electric arc between great electrodes. Impurities are skimmed off the melted metal and alloys added. The electric furnace makes steel in 4 to 12 hours. The furnace here is tilted so that finished steel can pour into a ladle.

heat-resistant steels) are made in electric furnaces (*see also* Furnace; Electric Light and Power). These make from 5 to more than 100 tons in a single heat of from 4 to 12 hours.

Usually an electric furnace is charged with cold steel scrap and flux. Then electrodes are lowered and the current is turned on. From the furnace come crackling sounds, like rapid gunfire, as hot electric arcs leap between electrodes and scrap. As the charge melts, the flux (usually limestone) forms a slag with silicon, phosphorus, and carbon impurities. This slag is skimmed or drained off and another flux is added to combine with other impurities. Alloying elements, according to the kind of alloy steel wanted, are added. Among the most used alloys are nickel, copper, chromium, vanadium, and tungsten.

Steps from Liquid to Solid Steel

An open hearth is *tapped* through a hole opened into the hearth's bottom, while Bessemer converters and electric furnaces are tipped, to empty newly made steel into pot-shaped ladles lined with heat-resistant brick. Usually some slag is drained from open hearths during a heat, but some remains and flows into the ladles, floating on the liquid steel. Ladles contain only the exact amount of steel made by a furnace, and so the slag overflows into a *slag thimble* set beside the ladle.

Just before an open-hearth tap, the heated metal is not yet steel. The carbon and other elements that turn it into steel are added in the furnace or in the ladle. Molten metal gains carbon from molten or cold pig iron, spiegeleisen, ferromanganese (also a product of the blast furnace), or anthracite. Pig iron and spiegeleisen are added in the furnace, ferromanganese and coal in the ladle. Other common alloys are copper, molybdenum, chromium, and nickel.

After the steel in the ladle has cooled to a desired temperature, the melter signals the operator of a crane to lift and carry the ladle to the pouring platform. Small rail cars carrying *ingot* molds wait alongside this platform. The bottom of the ladle has a fire-clay nozzle. Through this, steel is *teemed* (poured) into one mold after another.

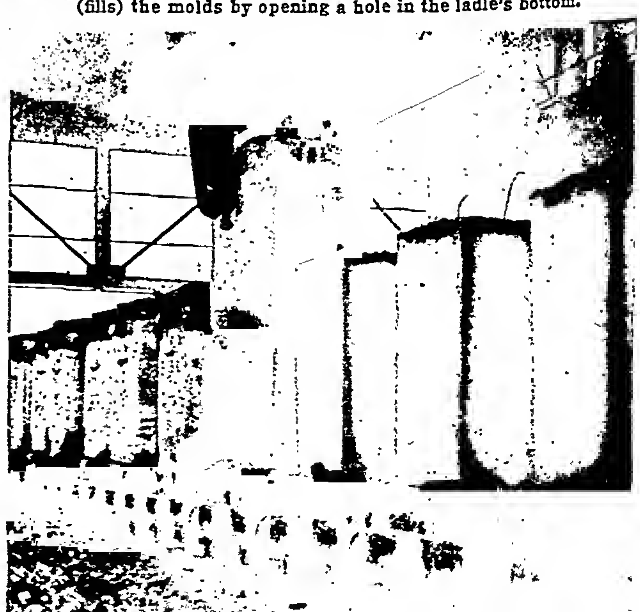
After the steel in the molds has solidified, the cars are pulled under a *stripping crane.* The crane's plunger holds down the ingot top as its jaws *strip* (lift) the mold from the still red-hot ingot. The ingots then are taken for further processing.

Shaping Steel for Use

INGOTS ARE shaped into useful objects by three processes: remelting and *casting; forging* (hammering or pressing); and *rolling* (squeezing between heavy iron or steel rolls). Casting does not change the quality of

FORMING MOLTEN STEEL INTO INGOTS

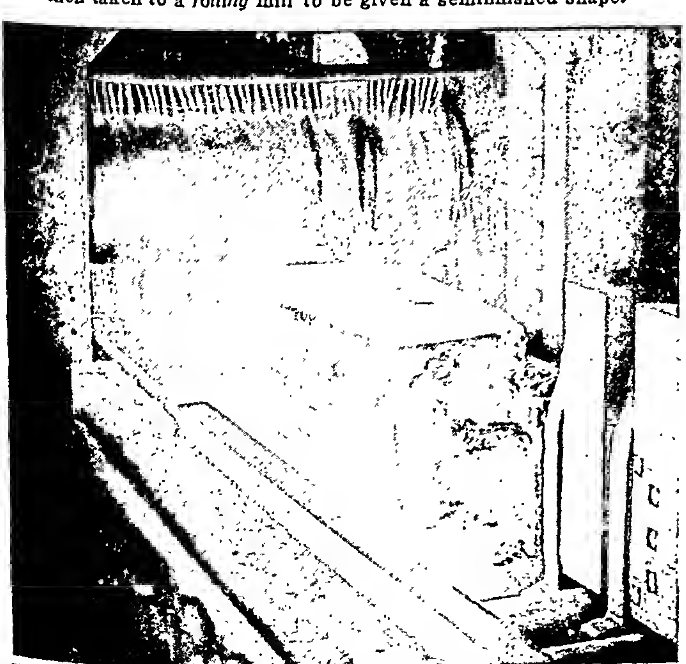
When a steel furnace is *tapped*, the molten steel flows into a ladle. Here a crane lifts the filled ladle over a string of flat rail cars holding ingot molds. From the platform at the left, a workman *teems* (fills) the molds by opening a hole in the ladle's bottom.



When the steel has solidified, the molds are *stripped* (lifted) from the still red-hot ingots by the jaws of a stripping crane. Ingots vary in weight from less than 5 tons to more than 100 tons, according to how they are to be used. The usual weights are between 5 and 25 tons.

PREPARING AN INGOT FOR FURTHER WORKING

A crane lifts the ingot from the flat car and lowers it into a deep furnace called a *soaking pit*. Here the ingot is exposed to heat until it reaches the same temperature throughout. The white-hot ingot is then taken to a *rolling* mill to be given a semifinished shape.



The ingot is *passed* (squeezed) back and forth between the heavy iron rolls of a *blooming* mill. The distance between the rolls is narrowed after every pass. The blooming mill lengthens the ingot and reduces it to whatever thickness is wanted for further working.

steel, but *mechanical working* (forging or rolling) improves it in three ways. It forces the grains closer together, closes cavities in the metal, and refines the crystalline structure. (*See also* Metal Working; Wire; Welding.)

For mechanical working, the ingot must have an even temperature throughout. Usually an ingot is taken directly from a stripping crane to a furnace called a *soaking pit*. Here the ingot is heated from one to eight hours. The time depends upon whether the ingot was hot or cold and on the kind of steel it is. Soaking-pit temperatures range from 1,290° to 2,550° F. Low-carbon steels must be worked at higher temperatures than high-carbon steels.

Semifinished Rolling

A crane lifts the ingot from the soaking pit to a rail vehicle called a *pot car*. This car carries it to one of the semifinishing mills or to a *universal plate* mill. The latter rolls usable plates from an ingot. *Blooming* and *slabbing* mills roll the ingots to shapes that will be rolled further in finishing mills.

Blooming mills have two or three great rolls and are called "two-high" or "three-high" mills. The two rolls of the two-high can be reversed so that the ingot is flattened and lengthened as it passes back and forth between the rolls. The top and bottom rolls of the three-high turn in one direction and the middle roll turns oppositely. The steel is flattened first between the bottom and middle rolls and thrust out onto a *runout table*. The table rises and the steel then passes back between the top and middle rolls. A third type of blooming mill, the *continuous* mill, has nine *stands* (sets) of two-high rolls. The steel makes one pass through each stand.

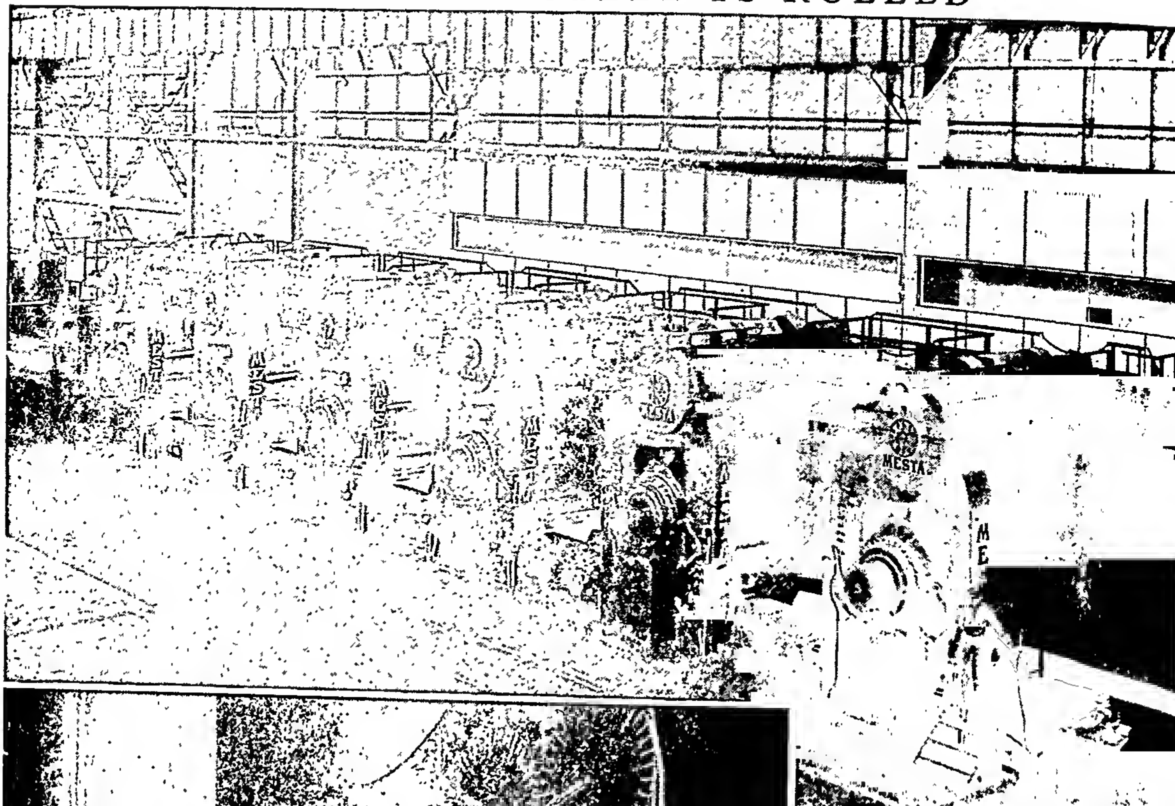
The two- and three-high blooming mills roll the top and bottom of the steel in every pass. Mechanical devices on the runout table turn the steel after one or two passes to bring the side surfaces under the rolls. After the steel is rolled, the uneven ends are sheared off and the single long piece is cut into small lengths.

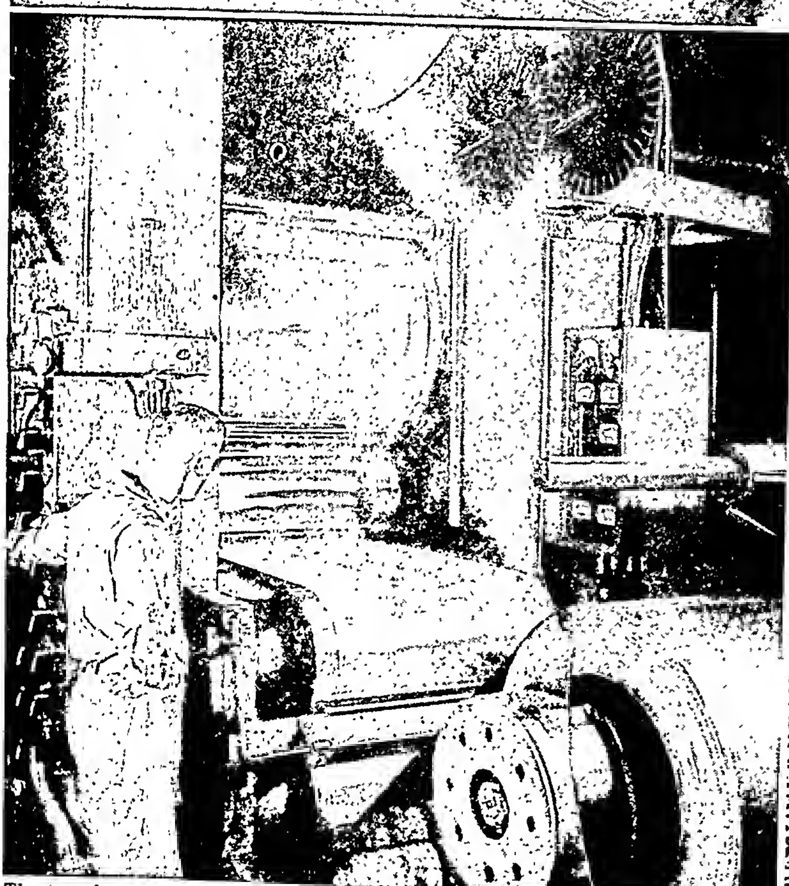
The shapes rolled in the blooming mill are called *blooms* and *slabs*. A bloom may be round, square, or rectangular in cross section. A slab is a flat, wide piece of steel from three to six inches thick. The slabbing mill can roll a wider slab than the blooming mill. In it the steel does not need to be turned between passes because the mill has both vertical and horizontal rolls. These squeeze top and bottom and sides of the steel in each pass.

Finishing Mills

More rolling of blooms and slabs turns the steel into finished products. These may be made by one or several more rollings. Most of the finishing mills perform their functions in one continuous operation. The stands are

HOW STRIP STEEL IS ROLLED



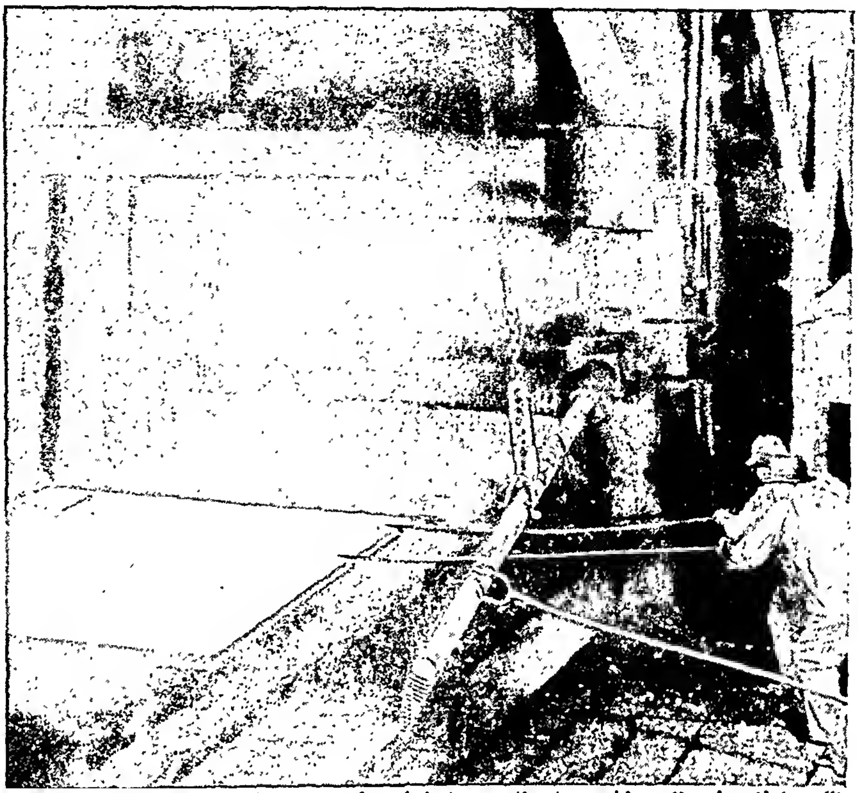


The top picture shows a *continuous hot strip* mill. The steel worked in this mill is reduced to working size in the semifinishing mill and reheated before it is brought to the strip mill. Each one of the six *stands* (set of rolls) squeezes the strip thinner and longer, and so the rolls of each succeeding stand turn faster than the ones before it. As the strip leaves the mill it travels at a speed of about 20 miles an hour. At the lower left is a *continuous cold strip* mill. Cold rolling gives the steel a glistening surface and a compact grain structure. The three pictures at the lower right show pieces of metal magnified 200 times. The first is cast iron; the black streaks are carbon. The others are low-carbon steels. The second has been hot rolled. The fine-grained specimen at the bottom was first hot rolled, then cold rolled and *annealed* (heat treated).

lined up so that each receives the steel in turn. In some of these mills, several stands will roll sections of a long length of steel at the same time. To keep pace with the constantly lengthening steel, the rolls of each succeeding stand must turn faster than the ones before it. Some continuous mills are of the *universal* type. Like the slabbing mill, they roll four surfaces of the steel at one time. Still other mills roll special shapes, such as I-beams or railroad rails. The rolls of these mills have the pattern to be formed cut into their surfaces.

Rectangularly shaped blooms are finished into structural shapes such as beams, girders, sheets, rails, skelp (from which pipe is formed and welded), and small pieces for forging. Cylindrically shaped blooms are finished into light wheels and other circular shapes. *Billets*, a semifinished form, are also rolled from blooms. They are finished into bars, rods, bands (as for binding cotton bales), hoops, various small shapes, and small pieces for further shaping by forging. Slabs are finished into plates (as for steel flooring) and hot-rolled strip. Some of this strip is further rolled into cold-rolled sheets or strip. Many steel products are heated and rolled several times before they are finished.

HOW A SHIP'S PLATES ARE ROLLED



The plates for a ship's skin are reduced between the two wide rolls of a *plate* mill. The mill is reversible. The rolls are set closer together after each pass. The mill passes the plate back and forth until it reaches the required thickness.

Cold-Rolled and Coated Steels

Steel shaped or reduced while cold (between 50° and 240° F.) can be more carefully controlled as to width, thickness, and quality. Cold rolling gives steel a fine surface finish and a variety of other desirable qualities.

Some sheets and strip are produced by cold rolling. These vary from 12 to 24 inches wide and from less than 0.0142 inches to more than 0.2499 inches thick. Strip comes in very long lengths and is coiled. Sheets are short lengths cut from coils.

Hot-rolled strip is run through a *pickling* (cleaning) bath, then washed, dried, and coiled. The coil is mounted at one end of a cold mill with either one or several stands. The rolls are tightened down onto the strip until it is reduced to the correct thickness. In a mill of several stands, the rolls of each succeeding stand are set closer than the one before it. The single-stand rolls are reversible, so that the strip is rolled in one direction, the rolls moved closer together, and the strip then rolled in the other. As it emerges from the mill, the strip is recoiled. The tension maintained on the strip from both the unwinding and winding reels helps to keep the quality of the steel uniform.

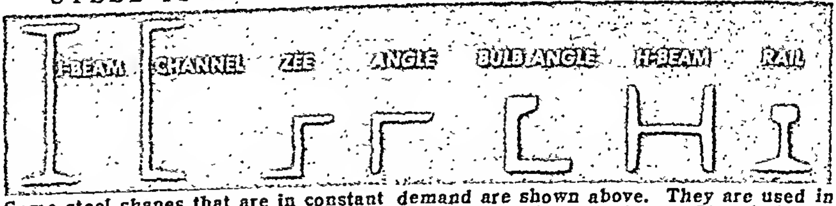
Much cold-rolled sheet and strip is coated with substances to provide corrosion-resistant surfaces or surfaces to answer some other need. The most usual coatings are tin, zinc, terne metal (tin and lead), nickel, chromium, cadmium, copper, aluminum, and bronze, and paints, varnishes, enamel, and lacquer.

Metallic coatings are most usually applied by *hot dipping* (immersing) the steel in a molten bath of the coating metal or by *electroplating*. (*See also* Electrolysis; Tin; Zinc.)

Forged and Cast Steel

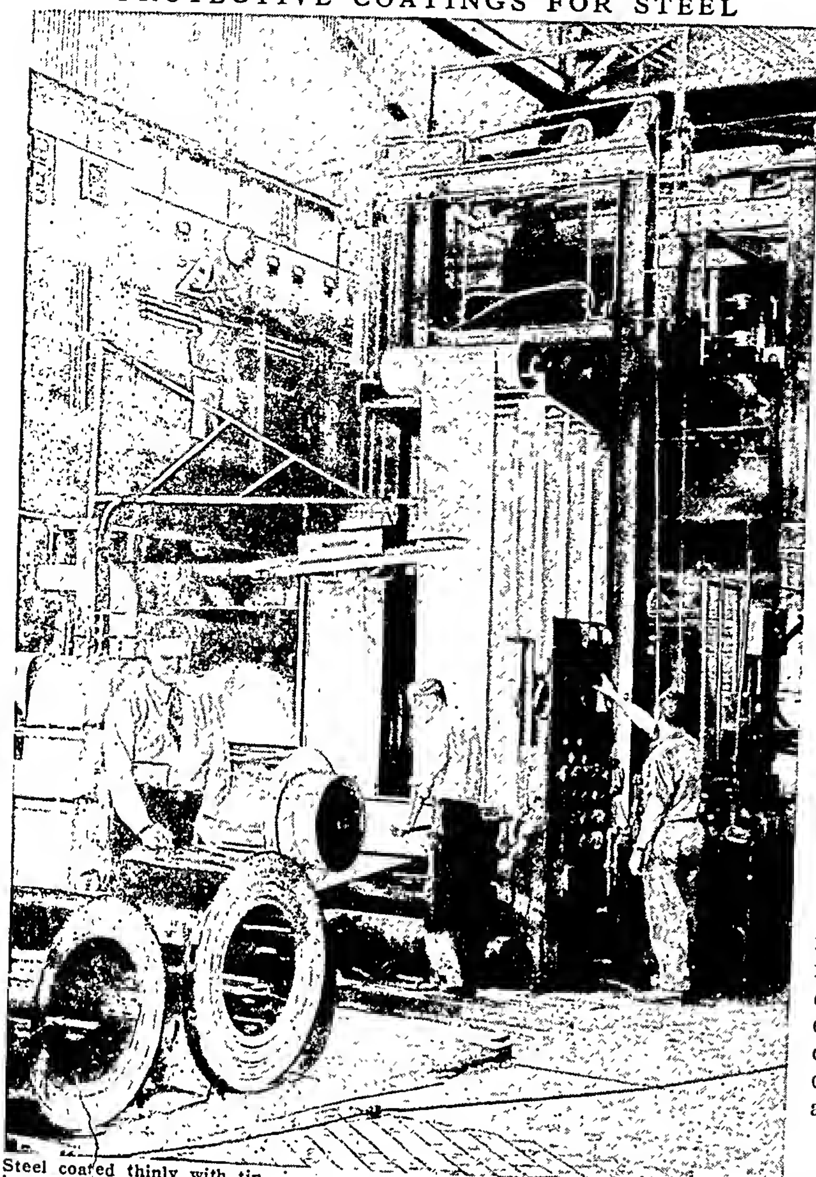
Very large forgings are hammered out of whole ingots. Small forgings are hammered out of pieces rolled from billets. The forging piece is heated white-hot and pounded to the desired shape under steam or electrically powered *taps* (heavy steel hammers). Railroad-car axles are shaped in this way. Steel also is *press forged* between two dies cut in the desired pattern. The lower die is stationary. Hot steel is placed

STEEL IS ROLLED INTO MANY USEFUL SHAPES

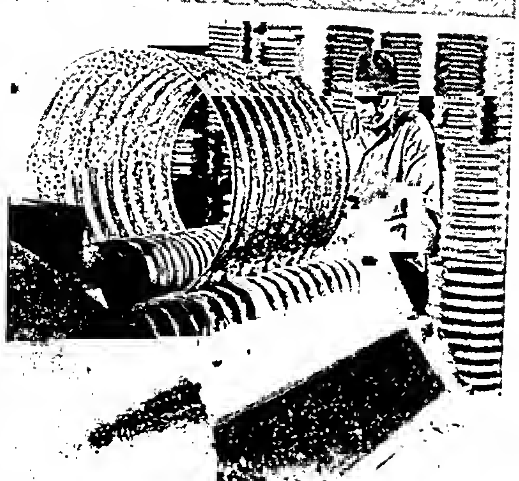


Some steel shapes that are in constant demand are shown above. They are used in buildings, bridges, towers, railroad track, and many other structures. Steel is forced into these shapes by rolls that have the patterns cut into their surfaces.

PROTECTIVE COATINGS FOR STEEL



Steel coated thinly with tin is used for many purposes, such as in making food cans. Tin is coated on steel by dipping it in a bath of molten tin or by electroplating. The picture above shows strip coming from an *electrolytic tin-plating* machine. The man on the platform watches the surfaces to detect flaws in the coating. The coiled strip will be cut into short lengths. The short lengths will be inspected again for flaws.



A zinc coating prevents steel from rusting. Plating with zinc is called *galvanizing*. Steel sheets are galvanized by dipping them in a bath of molten zinc. Galvanized steel is made into roofing, siding for buildings and grain bins, water spouts, pails and cans, and many other things. At the right, a *corrugating* machine shapes galvanized steel to be used as lining for an under-the-road culvert.

on the die, and the upper die is forced down on the steel under thousands of tons of pressure. Railroad-car wheels are press forged.

Steel is forged into crankshafts for automobile engines, parts for locomotives, and many other articles. Almost all forgings are further treated by rolling or machining.

Melted steel is cast in many large shapes too intricately formed to be rolled or forged. One example is the huge framework of a locomotive. The molds in which steel is cast are formed of fine sand and a good quality of fire clay.

Special Treatments for Steel

After semifinished rolling, small defects become visible on the surface of the steel. Hot rolling and forging result in *scale* (thin sheets of oxidized iron on the surface of the steel). Oils used in cold rolling cling to steel surfaces. And dust and other foreign matter also adhere to steel surfaces. Steel that is to be coated must have clean, whole surfaces. It also is desirable to remove surface defects.

Defects are removed from near-finished pieces by grinding or filing or by blasting with sand or other abrasive particles. Defects found on surfaces of large semifinished pieces are removed by *chipping* with a pneumatically powered chisel or by *scarfing* (burning out with a torch). Surfaces are cleaned by running them through an acid bath.

Heat Treating Steel

Mechanical working of steels causes internal stresses and changes in grain structure. These combine to make the metal harder. Heat treating relieves stresses and can soften or harden steels. The temperatures of treatments vary from very high to relatively low, according to the object in view and the composition of the steel being treated.

Normalizing steel restores the metal to what it was before working or to a "normal" grain structure. A steel is normalized by heating and then cooling in still air.

Annealing softens steel by relieving stresses set up in working. Annealed steels can be more easily machined. To anneal it, steel is

heated and then cooled very slowly to atmospheric temperature.

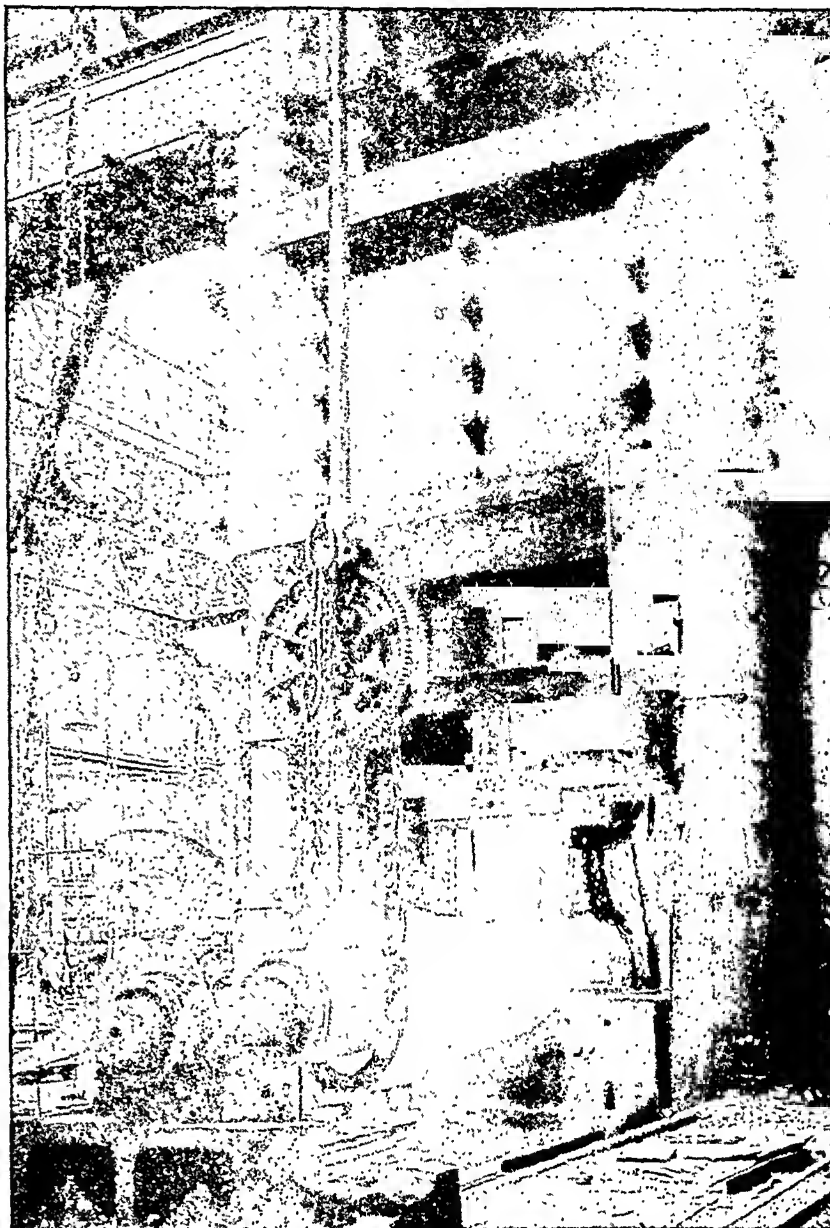
Hardening steel is done by heating and then cooling very rapidly. Cooling, also called "quenching," is done by plunging the hot steel into a liquid, usually water or oil, or by exposing it to blasts of cold air. The sudden cooling hardens the steel, but it also causes new stresses. To attain the proper degree of hardness and to relieve the newly set-up stresses, hardened steel is *tempered* (or drawn). To temper it, steel is reheated to a temperature below that used for hardening and then allowed to cool slowly.

Case hardening gives steel a hard surface but leaves the metal underneath as it was before. The soft interior metal, then, is "cased" in hard metal. Steels are case hardened by surface absorption of nitrogen, of carbon and nitrogen, or of just carbon. In *nitriding*, steel is heated in a closed container with active nitrogen. In *cyaniding*, steel is heated in a bath containing sodium cyanide, calcium cyanide, or calcium cyanamide (compounds containing carbon and nitrogen). In *carburizing*, steel is heated in contact with carbon-bearing materials such as charcoal, charred bone, charred leather, or bituminous coal or heated in a closed container with carbon-bearing gases or liquids. (*See also* Cyanides; Nitrogen.)

History of Iron- and Steelmaking

KNOWLEDGE of how men first used iron is a mystery of bygone ages. Perhaps the first ironworker found a meteorite buried in the ground. It had been refined to almost pure iron by heat generated by flight through the earth's atmosphere, and with a rock he could pound it into a crude knife. Or perhaps some ancient man built a cooking fire over an outcropping of ore. After the fire went out he found a small lump refined into iron by the fire. Most of the iron early men used must have come from meteorites (*see* Meteors and Meteorites). The ancient Egyptians called iron "metal from heaven."

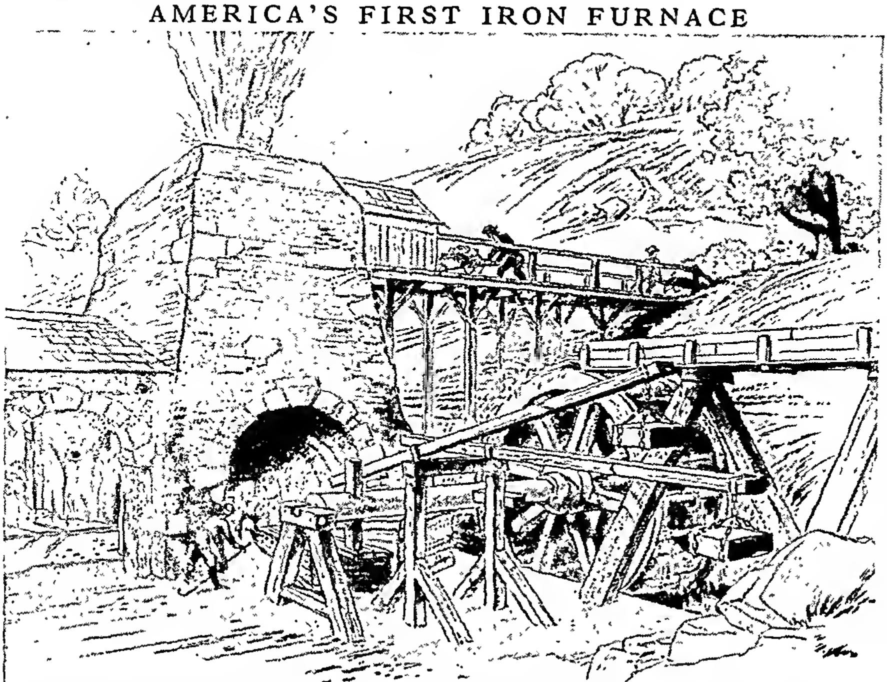
HAMMERING AND PRESSING STEEL TO SHAPE



Hammering or pressing steel into a desired shape is called *forging*. Above, a giant hydraulically powered *tup* (hammer) shapes a piece of white-hot steel into a cannon. The heavy wheels and chains seen in the foreground and beyond and to the left of the tup lift the forging pieces when it is necessary to change the position of the cannon. The man at the extreme left operates the levers that control the tup.

A forging press makes desired shapes by pressing red-hot steel between two dies under thousands of tons of pressure. At the left, a railroad car wheel has just been removed from the lower die. Under the pressure, oxygen in the air combines with surface steel and forms a thin sheet called *scale*. The man directs the blast from a compressed air hose to blow scale from the wheel.

AMERICA'S FIRST IRON FURNACE



The first successful ironworks in the American Colonies was built on the bank of the Saugus River, near Boston, Mass. Iron ore, limestone, and charcoal were wheeled from the bank across the bridge and dumped into the top of the furnace. The water wheel operated a big bellows. The bellows blew the air blast that made the fire burn hot enough to melt iron.

Iron long remained a precious metal. Archeologists took a beautifully decorated iron dagger from the tomb in which Tutankhamen was buried about 1350 B.C. The early Romans shaped iron into rings. In England as late as A.D. 1300, iron cooking pots, spits, and frying pans were listed among the royal jewels.

Early Iron and Steel Manufacture

The manufacture of iron from ore began well before 1300 B.C., in eastern and southeastern Mediterranean lands, replacing bronze (*see* Bronze). China and India developed the art independently about the same time. The Hittite army of about 1300 B.C. had iron weapons. The Bible (I Chronicles xxii, 3) tells of David, about 1000 B.C., preparing "iron in abundance for the nails for the doors of the gates, and for the joinings . . . " of a temple.

Herodotus, about 500 B.C., told of the Chalybeans making steel from iron. The Chalybeans lived on the southeastern shores of the Black Sea, in the present-day Soviet Union. The Medes and Persians and the peoples of China and India also were early steelmakers. The Indians made steel surgical instruments as early as 350 B.C., and the famed "swords of Damascus" were fashioned in Syria of steel imported from India. The ancient Greeks gave steel axes as prizes in their games. The Romans' rise to world power was aided by superior iron and steel weapons and armor.

Early Asiatic or European forges were little more than stone fireplaces. When charged with ore and charcoal, they yielded small, pasty lumps of iron. Impurities and carbon were hammered out of the lump to make *wrought iron* (still valuable for some purposes). About A.D. 1350 Central European ironmakers developed a masonry furnace. A weak stream of air was blown into the bottom of this to make the charcoal burn hot enough to melt iron. This furnace was the forerunner of the modern blast furnace. English ironmakers adopted the new method about 1500. They first used coke in place of charcoal in 1619.

America's First Iron Furnaces

In 1585 Sir Walter Raleigh found iron ore on an island near the North Carolina coast. English authorities already feared that the ironmakers' need for charcoal would strip England of forests. So Virginia settlers were encouraged to make iron. A furnace was built at Falling Creek. On the day in 1622 when its fires were to be lighted, Indians wiped out the settlement and destroyed the furnace.

America's first producing furnace was built at Saugus, Mass., near Boston, in 1643. It refined bog ore from a nearby swamp. A cooking pot from its first cast is now a treasured museum piece.

Other New England colonies built iron furnaces, and the discovery of rich magnetite ores in New Jersey aided that colony to become one of the biggest producers of iron. High-grade ores were found in Pennsylvania too. Here the iron mine, the furnace, and the surrounding woodland that supplied wood for charcoal came to be called an "iron plantation." Hopewell Village, now restored as a National Historic Site, and nearby Valley Forge were iron plantations.

When English ironmakers used coke in place of charcoal, England no longer feared the loss of her forests. Then English ironmakers began to fear the competition from the colonies, and American iron production was discouraged. The colonists, nevertheless, continued to make iron. During the American Revolution, they made iron for American cannon and other arms.

The Development of Modern Iron- and Steelmaking

BLAST FURNACES remained small and crude until well into the 1800's. They were built very little larger than the Saugus Mill. Their stonework pyramids enclosed a circular shaft about four feet in diameter and 30 feet

high. These furnaces could make from one to six tons of pig iron a day. After the 1850's, larger furnaces were built; and by 1880, the biggest furnaces made about 100 tons a day. The biggest modern furnaces make about 1,500 tons in 24 hours.

Old Ways of Making Steel

Methods of making steel were known as long as 2,000 years ago. Over the centuries the methods have been lost and rediscovered again. The old processes were called *cementation* and *crucible*. They took much time, and the steel was so costly that it could be used for only a few articles, such as swords, armor, razors, knives, and axes.

To make steel by the cementation process, alternate layers of wrought-iron bars and charcoal were packed in a small furnace and covered so that they remained almost free from air. In three or four days the metal reached a red heat (1,482° to 2,012° F.). The metal was kept at red heat from seven to twelve days. During this period it absorbed up to about 2 per cent carbon. The metal had become tough but malleable steel, although somewhat imperfect.

The crucible process differed in that a clay box or jar (crucible) was packed with wrought iron and charcoal and heated in a furnace for several days. The metal absorbed some carbon and became steel.

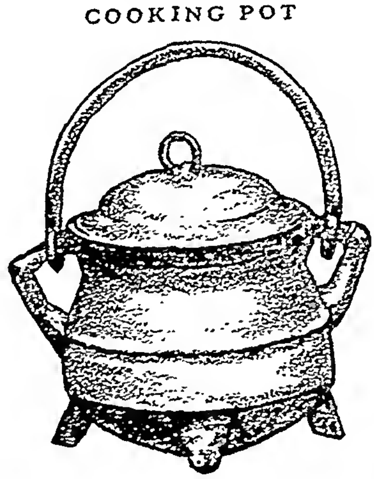
In the 1740's an Englishman, Benjamin Huntsman, combined the two processes to make fine steels. He packed cementation steel (sometimes called blister steel) into airtight crucibles and placed them in a furnace. The furnace heat melted the metal and eliminated some carbon and other impurities. Today crucible steels are used to make high-quality cutlery and tools. But the steels made in electric furnaces have largely replaced them.

Another invention of the 1700's that made a larger use of metal possible was the shaping of it by rolling. An Englishman, Henry Cort, built his first rolling mill in 1783.

The Beginning of the Steel Age

The Iron Age began about 1000 B.C. and ended about 1860. The Steel Age replaced it. In the middle of the 1800's, William Kelly and Henry Bessemer almost simultaneously discovered the same process for making steel quickly, cheaply, and in large quantities.

COOKING POT



This pot, now a treasured museum piece, was cast in 1644 from the first iron made in America.

Kelly was a Kentucky ironmaker. In 1847 he noted that molten iron did not chill but grew hotter under a blast of cold air. He correctly surmised that oxygen in the air blast was combining with impurities in the iron and burning. He experimented with ways of making steel by use of an air blow.

In England in 1854, Bessemer undertook similar experiments. His work became better known, and this method of making steel is called the Bessemer process. An Englishman, Robert F. Mushet, devised the way of making steel of the blown metal. He added spiegeleisen metal to it after the blow.

The Invention of the Open Hearth

Until 1909 America made more steel in Bessemer converters than by any other process. That year open-hearth steel took the lead. The inventor of the open hearth was another Englishman, William Siemens. He built his first experimental furnace in 1858. He patented his furnace in 1861. In it he used the *regenerative principle* of employing the open hearth's burned gases to heat incoming air and fuel so that they would burn at great heat.

Siemens' early furnaces were used to make glass, to distill zinc, to remelt iron and steel, and to make crucible steel. But he attained no real success in producing steel from pig iron. In France, the Martin brothers made the open hearth a successful steelmaker by adding scrap metals to the charge. Siemens' furnace had a capacity of only four or five tons. Today, the average open hearth has a capacity of 125 tons and there are some that make as much as 550 tons in a single heat.

The Invention of the Electric Furnace

Steel was first made with electric heat by W. H. Pepys, in England, in 1815. He packed diamond dust (pure carbon) around a wrought-iron wire and passed an electric current through it. The heated wire absorbed carbon from the dust and became steel.

Siemens, the inventor of the open hearth, was the first to use the heat of an electric arc to melt steel. By 1890 several other inventors were working on electric steelmaking furnaces. From their experiments two types of furnaces resulted: one that heats by an arc between carbon electrodes and one that heats by the inductive principle.

The Three Steelmaking Processes

The superiority of the electric furnace lies in the greater heat it generates and in the exact control that can be exercised over that heat. It is the most expensive of the steelmaking processes and is used to make expensive alloy steels. Electric furnaces produce about 5 per cent of American steel.

The Bessemer converter can produce steels within only a narrow range of chemical analysis. Bessemer steels are used as screw stock and for certain kinds of wire, sheets, tin plate, tubes and pipes, and for various small shapes. Somewhat less than 6 per cent of the steel produced in America is made in Bessemer converters.

In the United States steel industry, the open-hearth method of making steel carries the great load. It has a number of advantages over the Bessemer converter. In the open hearth both the furnace temperature and the molten metal are under better control. It can turn a wider variety of raw

materials into steel. And out of a given amount of pig iron, it can make more steel. Open-hearth steels are of all kinds, including plain and alloy steels. About 90 per cent of the steel produced in the United States is made in open-hearth furnaces.

The Importance of Iron and Steel Scrap

About 50 per cent of American steel is made of iron and steel scrap. Scrap metals are those that are either wornout or are no longer used. They may be any discarded article made of iron or steel. Scrap is collected from railroads, factories, farms, and homes. Metals that are salvaged from these sources make up about half of the total scrap used in steel mills. The other half comes from the mills themselves in the form of steel that is flawed, ends of ingots, blooms, and billets, and shavings, filings, and other wastes.

World Output of Steel

The United States makes about half of all the steel produced in the world. During the second World War steel production capacities were increased in many countries, but in those occupied or devastated by the Germans, production declined.

After the war, as a result of mounting tension between the Soviet-controlled countries and the Western nations led by the United States, both capacities and production of steel were increased throughout the world. The capacity of the United States grew from 91,000,000 tons in 1947 to more than 100,000,000 tons in 1951. America's greatest new plant was started in 1951 on the Pennsylvania bank of the Delaware River, near Trenton, N. J., to use Venezuelan and Labrador ores. This plant has a yearly capacity of about 1,800,000 tons.

The ten leading steel-producing nations and their approximate yearly production in tons are:

Nation	Tons
United States	105,000,000
Soviet Union	27,000,000
United Kingdom	17,000,000
Germany	14,000,000
France	9,000,000
Japan	5,000,000
Belgium	4,500,000
Canada	3,500,000
Czechoslovakia	3,000,000
Poland	2,700,000

New Developments in the Steel Industry

Science and invention play indispensable rôles in the iron and steel industry. Chemists test every step in production from raw materials to the finished steel article. Other scientists exhaustively test qualities of steel and steel alloys by hammering, bending, twisting, cutting, and pulling apart in machines especially designed for such tests. Steels also are tested for dependability under extremes of heat and cold.

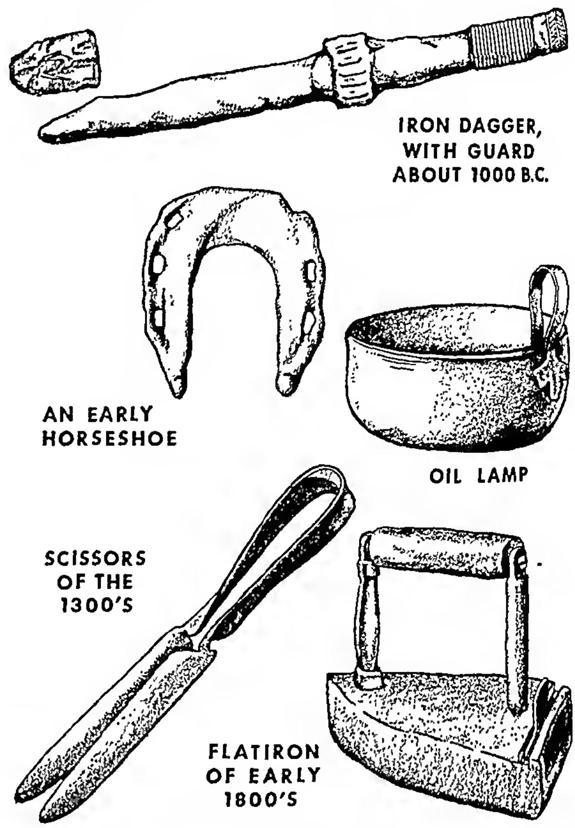
In the late 1930's, Italian steelmakers invented a method for squeezing cold steel into desired shapes under pressures of 100 tons to the square inch. The process is called *extrusion.* It is used principally to form cartridge cases for guns of all sizes. The Germans used this method during the second World War. After the war, American steel producers brought the process to the United States.

In 1948 an American company announced a method of continuous casting of billets from molten steel that has just been tapped. The method eliminates casting steel into ingot molds, cooling, stripping molds from ingots, reheating ingots in soaking pits, and semifinished rolling. In the process, molten steel is cast at the top of a high tower into a brass mold. As the steel descends through the mold, it is cooled, hardened, and with a torch is cut to desired lengths.

In 1950 American steelmakers announced a new steel furnace called the *turbohearth* and a method for making extra-hard stainless steel. The turbohearth makes steel in about 12 minutes without fuel. As in the Bessemer process, air combines with impurities in molten pig iron and burns them out. The blow, however, is made over the top of the metal, instead of through it, as in the converter.

The inventors of this method claim that a 30-ton capacity turbohearth can make 480 tons of steel in an eight-hour day and that the steel is equal in quality to open-hearth steel. To make very hard stainless steel, the metal is immersed in liquid nitrogen at a temperature of −300° F. and rolled or forged while still cold. The theory is that the cold and the working combine to an advantageous rearrangement of atoms that makes the steel harder.

SOME EARLY IRON ARTICLES



These crudely made iron articles were the finest of their day. Compare them with their modern iron and steel counterparts

Iron Mask, Man in the. In the gloomy Bastille of Paris, in the days of Louis XIV of France, there dwelt a mysterious prisoner known as "The Man in the Iron Mask." Who he was and why he was imprisoned, few knew then, and no one knows today. No one was permitted to look upon his face, for it was always covered with a mask, not of iron, but of black velvet. All we really know of this silent figure is that he had been brought to the Bastille in 1698 from another prison, that he died in 1703, and that his name was recorded as Marchiel—but that was undoubtedly a false name.

Many theories have been advanced as to who the Man in the Iron Mask was. One is that he was Matthioli, the chief minister of the Duke of Mantua. This minister, in return for a large bribe, had promised Louis XIV to betray to him an important frontier fortress belonging to his master. He failed to keep his promise, however, and so Louis had him seized and imprisoned in France for the rest of his life. There are many other theories as to his identity. One of the earliest and most persistent and least credible is that the Man in the Iron Mask was a brother of Louis XIV. (*See* Louis, Kings of France.)

Turning DESERT *and* SWAMP *into* FERTILE FIELDS

Irrigation and Reclamation. Half the farmers in the world need more water for their crops than they can get from rainfall. If a dependable supply of water is within reach, they bring it to their fields to irrigate them. In one place sweating men and women may work all day to draw a few gallons of water from a well or stream for irrigating three or four acres. In another, engineers build a huge dam across a mighty river and lead water through canals to reclaim thousands of acres of desert.

Along with its desert regions, the world has areas that are too wet to be cultivated. Wherever coastal plains border the oceans, low sections may have water standing in shallow lakes and swamps. Alluvial plains beside rivers may also be soggy and poorly drained. When the river rises the lowlands are flooded. People seek to reclaim the wet lands for farming too. Reclamation projects vary just as irrigation projects do. In one area a ditch or a tile pipe line may carry the water off. In another, miles of mammoth dikes are constructed to hold back the river or the sea, and pumps work night and day, taking up the water that seeps onto the land.

Irrigation in Ancient Times

Irrigation was well established at the dawn of history. In fact, the world's early civilizations developed in localities where the people grew a dependable food supply with the aid of irrigation. The leading regions were in the Nile Valley of Egypt, Mesopotamia between the Tigris and Euphrates rivers, and parts of Persia, India, and China. Articles elsewhere in the encyclopedia tell how these civilizations developed (*see* Civilization; Asia; Egypt; Babylonia and Assyria). The article on Mesopotamia also tells how ruthless conquerors wrecked the region's canals and let much of the land return to desert.

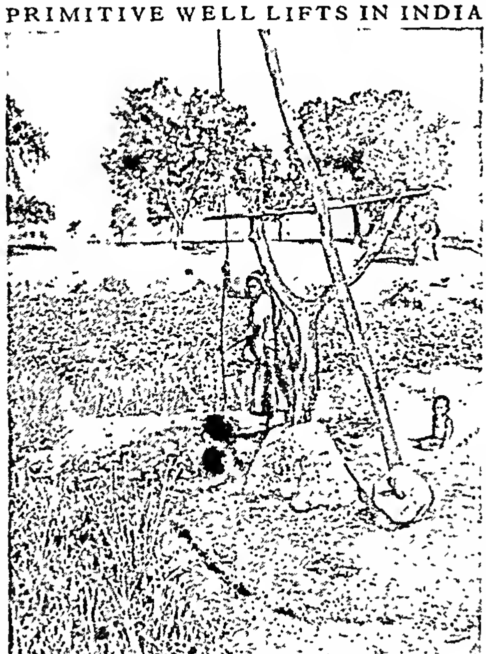
In prehistoric America, the Indians in dry areas of South and Central America, Mexico, and southwestern United States irrigated their fields. These peoples became much more civilized than those who lived as hunters in the well-watered eastern part of North America.

Where Irrigation Is Needed

Irrigation is essential to farming wherever rainfall amounts to less than 10 inches a year. In regions with 10 to 20 inches of rainfall annually, crops may be grown by dry farming methods, but irrigation farming is more dependable.

Rainfall maps in other articles show the arid parts of the earth where irrigation is needed (*see* Rainfall; World). Broad bands of desert lie in the trade-wind belts at either side of the tropics and in the interiors of continents, notably in Asia and North America. In these regions, mountain barriers wring the moisture from the rain-bearing winds.

PRIMITIVE WELL LIFTS IN INDIA



In the top picture, a Hindu woman uses the shadoof to draw water for her garden. A stone counterweight on the pole helps to lift the bucket. Bottom, oxen hitched to a beam on a toothed wheel plod in a circle to work an ancient Persian water wheel.

Irrigation is also needed if the seasonal distribution of rain and snow produces a dry growing season. Areas such as Italy and southern California which have rainy winters and dry summers (Mediterranean climate) need irrigation in summer. In parts of India and China heavy monsoon rains fall in summer; but crops grown before the rains start must have irrigation. (*See also* Winds; Climate; Deserts.)

The extent of irrigation in dry areas depends upon the supply of water available to land that is level and fertile enough for cultivation and upon the enterprise and ability of the people. The most important irrigated regions get their water from rivers that start in snow-clad or rain-swept mountains. Among the greatest of these are the Nile in Egypt, the Indus in Pakistan, and the Columbia, Missouri, Colorado, and Sacramento-San Joaquin systems in the United States. Irrigated areas also use smaller streams or get ground water through springs or wells.

Parts of an Irrigation System

Very few rivers flow uniformly throughout the year. To get a dependable water supply, engineers build dams to impound flood waters in storage basins, reservoirs, or lakes (*see* Dam). The stored waters flow through canals to the area to be irrigated. There ditches called laterals carry the water to the fields. Gates hold the water in the laterals until needed. Then it flows in furrows between rows of trees or crops or is used to flood the fields. A sprinkler system with elevated pipes is sometimes used with rough land.

Where water must be conducted for miles across rugged land, aqueducts and tunnels may be constructed. Huge siphons carry the water up and down hills and gullies. Pumping systems lift the water to benchlands high above its source.

Irrigation is frequently only one of the purposes served by large water-control systems. Power plants at the dams may harness the water to make hydroelectricity. Dams and storage reservoirs may be designed to prevent floods. They may also control the flow of the river to give the stream a stage (depth) suitable for navigation. Great storage reservoirs supply city water systems and serve as recreation lakes.

Early Irrigation in the Americas

The first important irrigation in the Americas was developed in Spanish America. The Spanish colonists found vast areas of dry land in the new world—in Mexico (which then included part of southwestern United States), Peru, Chile, and elsewhere. Indians had irrigated part of this land, and they themselves had come from a country where irrigation had been developed by the Moors. Thus irrigation became the mainstay of farming in these areas.

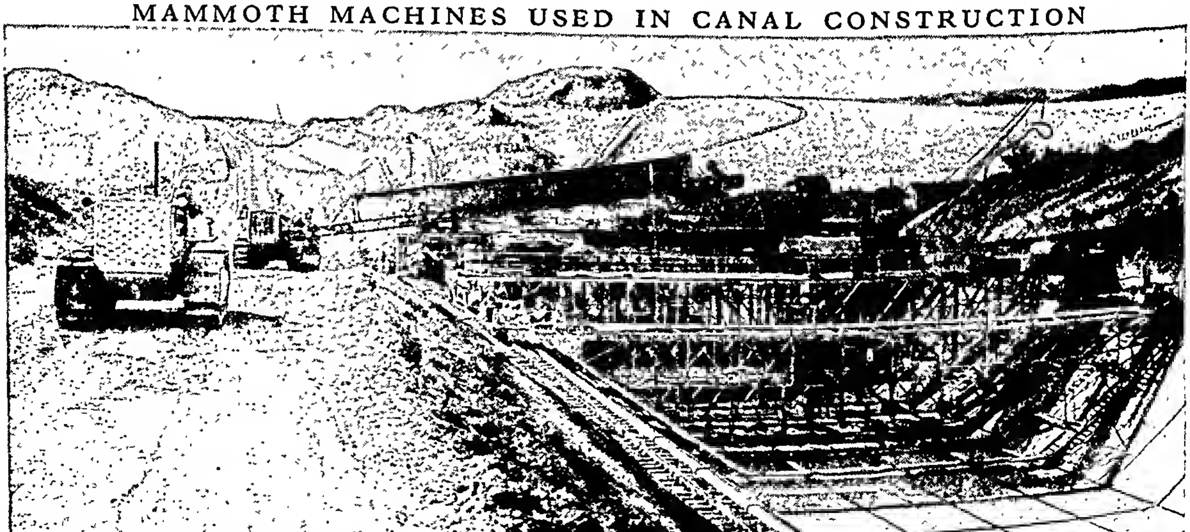
The United States was slow in developing important irrigation projects. The eastern part of the country has abundant rainfall. It was settled by people from Europe's humid lands who had farmed without irrigation. In the western third of the country more than 740,000,000 acres receive less than 20 inches of rain a year, and a fifth of this gets an average of less than 10 inches. As long as the East had room for more settlers, the people called the arid and semi-arid western land "the Great American Desert," and thought it worthless for agriculture.

Mormon settlers in Utah started the first considerable United States project on July 24, 1847 (*see* Utah). As settlers moved into the West, irrigation spread. First, individual farmers drew off water from the nearest stream for their fields. Then associations of farmers and commercial firms built dams, canals, and other works. By 1900, some 9,500,000 acres were under irrigation.

The Federal Government's First Projects

In 1902 Congress passed the National Reclamation Act. This law started federal government construction of projects too large and difficult for individual

MAMMOTH MACHINES USED IN CANAL CONSTRUCTION



A far cry from the ditches of the pioneer settlers in the West is the modern irrigation project. It throws a network of canals and aqueducts across hundreds of miles of rugged terrain. Here we see a slipform, a gigantic device used in canal building. It moves by its own power along rail lines, forming the smooth, uniform concrete lining for the big ditch.

enterprises. The original act appropriated receipts from the sale of public lands in 16 states and territories for developing irrigation. The law at first applied to the following states: Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Utah, Washington, and Wyoming. Then Texas was added. Later legislation also provided new revenues, including 52½ per cent of the receipts from naval and public land oil reserves.

The early laws provided that water users should repay the cost of the works. Settlers taking up reclaimed lands were required to work the lands and to pay their shares of the original construction cost in 10 yearly installments. Later they were allowed to make 40 annual payments. One individual could hold from 40 to 160 acres. Later, when huge multiple-purpose projects came into use, costs were assessed against the different uses. Farmers paid one part, assessments were made for flood control and other benefits, and the balance of the cost was recovered through sale of water and power.

The Bureau of Reclamation of the Department of the Interior has charge of federal irrigation work. It plans and supervises construction and runs many projects. Others are turned over to organizations of water users for operation and maintenance. The Office of Indian Affairs handles projects on reservations.

CAREFUL USE OF IRRIGATION WATER

This sugar-beet grower has let water into the upper end of his ditch and blocked it off. Now he checks the wooden pipes (spiles) which admit the same flow of water to each furrow.

Extent of Irrigation in the United States

By 1940 some 20,500,000 acres were under irrigation in 17 western states, and water was available to another 7,000,000 acres. Of these totals, more than 5,000,000 acres obtained a full or supplemental supply from federally constructed projects. Projects in operation represented an investment of more than a billion dollars, and projects under construction raised the total investment another half billion. (For map of leading irrigated areas, *see* United States.)

Though the acreage fully watered by federal systems amounts to only about one-ninth of the West's irrigated land, the federal projects are the largest and most complex. In many instances they give a supplementary supply of water to private projects. Five of the great dams are the biggest concrete structures in the world. The Grand Coulee Dam in Washington is the most massive and Hoover Dam is the highest. The other three include Shasta and Friant dams in California and Marshall Ford in Texas. The Fort Peck Dam in Montana is the world's largest earth dam.

Outstanding Projects in the West

These are all parts of great multiple-purpose projects. Hoover Dam is the key structure in the development of the Colorado River in the Pacific Southwest. The system furnishes power for southern California industry, water for the city of Los Angeles, and irrigation for hundreds of thousands of acres of desert. The system includes the famous All-American Canal project in the Imperial Valley of southern California.

The Grand Coulee Dam began supplying power during the second World War, and the irrigation project followed. The plan calls for pumping Columbia River water into a natural storage basin called the Grand Coulee. It was on high land during the Ice Age (*see* Columbia River). From this coulee, 280 feet higher than the dam, water will flow to more than a million acres in the Columbia basin.

Shasta Dam on the Sacramento River and Friant Dam on the San Joaquin are part of the giant Central Valley project in California. It is designed to transfer surplus water from the Sacramento through canals into the San Joaquin Valley (*see* California). This complex engineering project is intended to assure a stable supply to millions of acres where privately built projects have been handicapped by spring floods, summer shortages, and a continuously falling water table.

Another outstanding engineering feat is the Colorado-Big Thompson project. Here the 13-mile-long Adams Tunnel runs eastward under the Continental Divide, and delivers enough water for more than 600,000 acres in the Platte and Big Thompson valleys east of the Rockies.

One of the oldest and most successful federal works is the Salt River project in the vicinity of Phoenix, Ariz. Here Roosevelt Dam stores the waters of the Salt River and more than 380,000 acres are irrigable. The Yuma project not many miles away supplies about 70,000 acres in Arizona and California. On the Boise project in Idaho, the Arrowrock Dam forms a reservoir to irrigate 300,000 acres.

Among the public and private projects that make the Salt Lake Valley of Utah a productive oasis are

the Strawberry Valley, Provo River, Moon Lake, and Weber River projects. In eastern Washington's apple-growing valleys more than 400,000 acres are watered by projects which tap the Yakima River system.

Other large projects in the West include the North Platte in Nebraska and Wyoming; the Rio Grande, irrigating land in New Mexico and Texas; the Newlands in Nevada; the Shoshone in Wyoming; the Belle Fourche in South Dakota; the Milk River and the Sun River in Montana; the Lower Yellowstone in Montana and North Dakota; the Grand Valley and the Uncompahgre in Colorado; the Umatilla and the Deschutes in Oregon; the Klamath in Oregon and California; the Owyhee in Oregon and Idaho; and the Minidoka in Idaho.

Several dams are being built in the Upper Missouri and its headwaters streams. They are part of the Missouri River basin project, a joint undertaking of the Bureau of Reclamation and the Army Corps of Engineers. The works are to provide irrigation water, power, and flood and navigation control (*see* Missouri River). In addition to the projects in the West, Arkansas and Louisiana have areas where irrigation is provided for rice growing.

Costs and Returns

The cost of irrigation works in the United States averages about $40 for each irrigable acre. Average yearly maintenance and operation costs more than $2 an acre. The value of irrigation is difficult to calculate fully. Irrigation multiplies the population that land will support. The 11 Mountain and Pacific states, with 90 per cent of the country's irrigation, more than quadrupled in population between 1900 and 1950, while that of the whole country had not quite doubled.

Returns from crops grown on irrigated land differ with prices paid for agricultural products. Crop value reported for federally irrigated land alone amounted to about $80,000,000 in 1940 and $232,500,000 in 1945. Vegetables are the most valuable crop grown on irrigated land. Fruits and nuts are second, and hay and forage third. Long-staple cotton and sugar beets are other important crops.

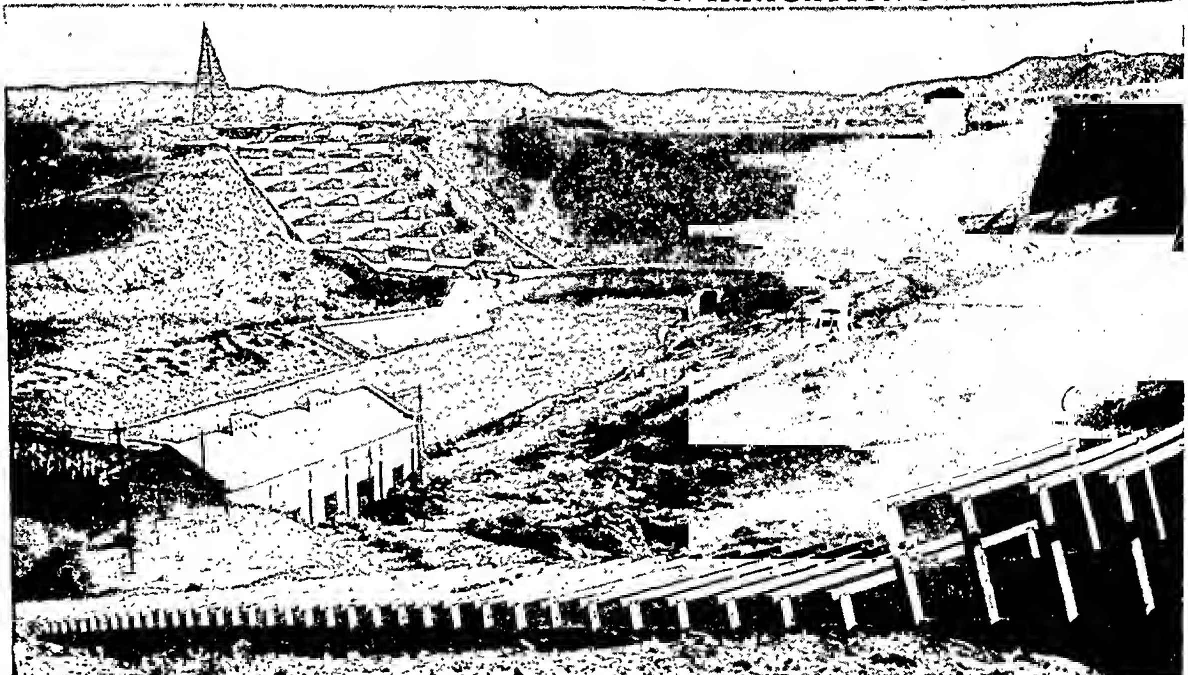
The World's Great Irrigated Areas

The peninsula of India contains the largest irrigated acreage of any region in the world. More than 70,000,000 acres are irrigated in India, Pakistan, and the native states. Thirty per cent of the irrigation comes from wells, and about 10,000,000 acres are irrigated from tanks, or reservoirs. But tanks may run dry in drought seasons, so throughout the past century vast dam and canal irrigation works were constructed (*see* India).

The arid Sind province in Pakistan contains the largest project—the Lloyd Barrage system at Sukkur on the Indus River. Seven huge canals carry water from the barrage (dam) to some 5,000,000 acres. In the Punjab, canal irrigation supplies more than 18 million acres divided between Pakistan and India. The Sutlej Valley project is the largest in the region. Another vast project is based on the Mettur Dam on the Cauvery River in Madras. It stores water for 1,300,000 acres and generates extensive power.

Egyptian irrigation depends entirely upon the Nile, and is controlled largely by the great Aswan

LAHONTAN DAM ON THE TRUCKEE-CARSON IRRIGATION SYSTEM IN NEVADA



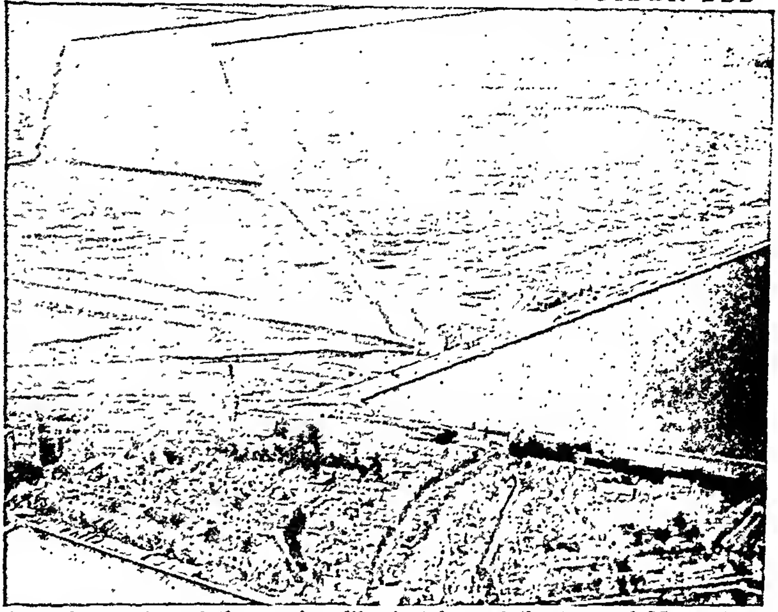
In the background are the dam and reservoir. The "stairways" on either side are spillways. The water flows down them to the stilling pool below the dam. It catches the rush of overflow and stills the water so it will not rush down too violently along the distributing channels and destroy their banks. Water also gushes through tunnels to the powerhouse at the left. There it spins great turbines and generates hydroelectricity.

Dam (*see* Egypt). Egypt's 5,400,000 acres of cultivated land are under irrigation.

In modern Iraq, the Tigris and Euphrates supply water for irrigation. Some canals are centuries old, and there are modern government-subsidized projects. In Iran, irrigation tunnels called *kanats* carry water to dry fields. They are tapped by wells and ditches. Soviet Russia has productive oases in middle Asia, where the Syr Darya and the Amu Darya rivers and their tributaries supply water for more than 4,500,000 acres. In China, Japan, Siam, and other parts of Asia where rice is the chief crop, irrigation is widespread. Government projects have been built in these countries to increase the crop, to make it more dependable, and to raise the living standard.

Canada's projects lie in the prairie provinces where rainfall is light and droughts frequent. Projects have been developed by water users, by the provinces, and by railroads and other commercial concerns. The passage of the Prairie Farm Rehabilitation Act by Parliament in 1935 led to large-scale undertakings. The cost is shared by the Federal government, the province, and the water users. In 1946 work started on the St. Mary-Milk rivers project to provide water for 345,000 acres in southeastern Alberta. Arid parts of Australia, Africa, South America, and the Mediterranean countries also contain numerous projects.

RECLAIMING FARM LAND FROM THE ZUIDER ZEE



Once the sea lapped the curving dike just beyond the town of Medemblik. Then engineers built a huge dike into the sea at right angles to the old one. The water behind it was pumped out and an extensive *polder* was reclaimed. Canals drain seepage water to a pumping station which lifts the water back into the sea.

Reclaiming Wet Land

Reclamation of swamps and flooded lands is not so widespread as irrigation. But in parts of the earth drainage achievements have been astounding. The most famous is the work done in the Netherlands to reclaim land from the sea. Nearly two-fifths of the country lies below sea level and thousands of acres of fertile farmland were sea bottom until the enterprising Dutch drained away the water. Dikes hold back the sea water, and pumps lift rain water and seepage into a network of canals that drains the lowland. The largest of these projects drained the Zuider Zee. It is still being extended (*see* Netherlands). Italy and Belgium have drained large marshes.

China's low Hwang River plain contains the greatest area of land protected by dike from a river. The territory is as large as England. When the dike breaks, floods sweep down from the river's high silted bed, wiping out millions of people and untold wealth (*see* Hwang River).

The United States contains some 90,000,000 acres of swampland. The largest areas lie in the silted lower valley and delta of the Mississippi River, the swampy tidelands of the Atlantic and Gulf coasts, the Everglades of Florida, and some lowlands in the glaciated Great Lakes states.

According to the 1940 census, 87,000,000 acres are in drainage enterprises of various kinds. Some 66,000,000 acres of this land are classed as drained sufficiently to produce a normal crop. Farmers carry on much of their drainage privately by ditching and tiling their land. Other work is done by corporations and by state and local government agencies.

Along the lower Mississippi a vast system of levees guards the alluvial valley from flooding (*see* Floods; Mississippi River). Much of the land below the level of the river is too wet for cultivation and requires drainage. Notable drainage projects are in the Everglades of Florida, in the upper Red River Valley in Minnesota and North Dakota, in the Kankakee marshes of Indiana, and in the lower Sacramento Valley.

WASHINGTON IRVING

Irving wrote fascinating tales of the Hudson River Valley.

IRVING, WASHINGTON (1783–1859). Essayist, historian, and writer of stories, Irving was the first of the great American writers. Before his time Europe had regarded American authors chiefly as curiosities. But it was quick to recognize the worth of this new writer, so graceful was his style, and so fascinating and delicate his humor.

Irving was born in New York City, then a town of about 25,000 inhabitants part of whom were Dutch and part English, and it was from this New York that he drew much of the material for his stories and sketches. Never a very strong child, he spent more time with dog and gun, rambling about the country regions which he later described, than he did in school. Sometimes too he wandered into the Dutch part of the city and listened to the quaint stories told by the

THE SMOKERS' REBELLION IN FULL BLAST

One of the innumerable funny stories in Irving's 'History of New York' tells how Wilhelmus Kieft, one of the Dutch governors of New York, thought that people talked politics too much. He said that smoking was the cause of it and issued an edict prohibiting the time-wasting and villainous practice. Whereupon the smokers, with those long, clay church-warden pipes and plenty of tobacco, gathered before the governor's house and calmly sat themselves down and lit their pipes. The rebels won. They "smoked the governor out." The picture is from a painting by the distinguished American artist, George H. Boughton.

Dutch descendants. At home he read a great deal in his father's large library. He was always cheerful, kindly, and sweet-natured, though a great part of his life was a struggle against ill health, grief, and uncongenial work. The day had not yet come when an American author could hope to support himself by his writing alone. For one thing, there was no copyright law to protect his work. For another, the book-buying public was small. (*See also* American Literature.)

Irving began the study of law, but his already delicate health was still further impaired by grief over the death of his fiancée. His family, therefore, sent him abroad, where he traveled in England, Holland, France, and Italy. When he returned, he wrote a humorous miscellany entitled 'Salmagundi', and a little later appeared his burlesque 'History of New York from the Beginning of the World to the End of the Dutch Dynasty', supposed to have been written by Diedrich Knickerbocker. Irving soon went abroad again on business for his brothers, and this time he met many famous writers in England and gained new inspiration.

He now set about writing in earnest. The first book he put out after this was 'The Sketch Book'. Sir Walter Scott helped him sell the book to an English publisher, and Irving received $2,000 for it. Irving remained abroad for many years, traveling, writing, and in the diplomatic service of his country. While minister to Spain (1842) he became interested in Spanish history, and his studies there furnished his lively imagination with plenty of material for 'The Alhambra' and his life of Columbus. The last 13 years of his life he spent at his home near Tarrytown on the Hudson, a region his pen made famous. He is buried in Sleepy Hollow Cemetery, near the road where Ichabod Crane fled from the headless horseman.

'The Sketch Book' is the most widely known of Irving's works. It contains 'Rip van Winkle' and 'The Legend of Sleepy Hollow', in which he used the legends the descendants of the old Dutch settlers had told him, the mysterious tale of the return of Hendrick Hudson and his men, and the ghost story of the headless horseman. One feels the very atmosphere of the sleepy country, with its quiet, prosperous folk. Other charming sketches are the essays on Westminster Abbey and the Shakespeare country. 'The Alhambra', named for the Moorish palace in Spain, contains tales of captive princesses and talking doves, of magicians and knights and peasants.

Irving's chief works are: *Sketches, essays, and tales*—'History of New York' (1809); 'Sketch Book' (1819); 'Bracebridge Hall' (1822); 'Tales of a Traveller' (1824); 'The Alhambra' (1832); 'Wolfert's Roost' (1855). *Histories and biographies*—'The Life and Voyages of Columbus' (1828); 'The Chronicle of the Conquest of Granada' (1829); 'The Life of Mahomet' (1849); 'The Life of Goldsmith' (1849); 'The Life of Washington' (1855–59).

ISABELLA OF CASTILE (1451-1504). It was the happy fortune of Queen Isabella of Castile and Leon to give to Europe a new nation and to the world a new continent. The first service came through her marriage in 1469, while queen of Castile and Leon, to King Ferdinand of the neighboring and rival Spanish kingdom of Aragon, thus uniting the two chief kingdoms in the Spanish peninsula. Her second claim to fame came through her support of Columbus.

Isabella was a woman of remarkable energy and talent, beautiful and possessed of winning grace, although at times proud and ambitious. She was always present at state meetings, and her name was placed with that of Ferdinand at the end of all official documents. Her part in the founding of a national Spanish inquisition under royal control, with its persecution of the Moors and Jews, shows the intolerance in religious matters which she shared with her husband and her times.

History relates that Christopher Columbus, when he applied at the court of Spain for help in his projected voyage of discovery, failed to receive the sanction or aid of Ferdinand and the learned council. Columbus, discouraged, was about to leave for France, when at last he succeeded in interesting Isabella in his plan. The king remained indifferent and claimed that he was short of funds. The queen, so the story runs, in her earnestness exclaimed: "I pledge my jewels to raise the money." Columbus succeeded at last, and to Isabella belongs the honor; for even though the story of the jewels has no basis but legend, it is true that it was Isabella's interest and support that made possible Columbus' voyage.

GODDESS OF THE MOON

Isis was often depicted with cows' horns and the moon's disk on her head.

ISIS (*ī'sĭs*). The queen of the gods in Egyptian mythology was Isis, the sister and wife of Osiris. She represented the moon as Osiris did the sun, and she was believed to have taught agriculture to the Egyptians. The old legends said that the tears she shed over her slain husband caused the yearly overflow of the Nile. She is frequently pictured with her infant son Horus. The cow was sacred to her and she is often represented with the horns of this animal. Alexandrian Greeks introduced the worship of Isis into Greece about the third century B.C. Her cult later became very popular in Rome. (*See also* Osiris.)

CALLED TO PRAYER

The minaret, at the top, is in Cairo. A muezzin, or Mohammedan crier (bottom), walks round its gallery three times a day, calling, "Come to prayer! Come to prayer!"

ISLAM. The religion founded by Mohammed is called Islam. This is also the name given to the group of countries where Islam predominates. Islam is an Arabic word for "submission," that is, to God's will. The creed of Islam is, "There is no God but Allah, and Mohammed is his prophet." A believer in Islam is called a Mohammedan or a Moslem, "one who submits."

The Islamic religion began in Arabia, the homeland of Mohammed, in the 7th century A.D. Within a hundred years the Arabs had spread it westward across North Africa, north to the Caspian Sea, and eastward into India. In the early Middle Ages Arab traders carried it to the Far East. Today Islam has about 300 million believers (*see* Religions). The history of Islam is described in the article Mohammed.

World of Islam

The Moslems occupy an irregular belt of land about 9,000 miles long. It includes all North Africa; the Arab states of the Middle East and the Arabian peninsula; Turkey, Syria, Iraq, and Iran; part of the Russian Caucasus; Turkestan; Afghanistan, Pakistan, and Kashmir; the Malay Peninsula; and the East Indies. Southeastern Europe, India, China, and the Philippines also have large Moslem populations.

In the Islamic world the Arabs still occupy a central position. Orthodox Moslems everywhere read Mohammed's sacred book, the Koran, in the original Arabic language. From all parts of Islam, Moslems make pilgrimages to Mecca, the holy city in Arabia; and five times each day they face this city when saying their prayers (*see* Mohammed).

Strategic Importance of the Middle East

Today the Middle East, core of the Islamic world, commands world-wide attention. Under the desert sands of Arabia, Iraq, and Iran are the world's greatest reserves of petroleum. Even more important is the strategic position of the Middle East. Here, where three continents come together, lies the most convenient route between the Western world and the Far East, by land, air, or water. Any conflict in this

region—such as the long strife between the Arabs and Jews in Palestine—becomes a threat to world peace. (*See* Palestine; Israel.)

For 150 years Britain defended this vital crossroads of its world empire against encroachment by Russia. Following the second World War, when Britain found itself in financial straits, the United States undertook to support Turkey, Iran, and Iraq against pressure from the Soviet Union. The United States also showed a growing interest in developing the oil reserves of the Middle East. (*See also* Mohammed and Mohammedanism; Mecca; Koran; Arabia.)

ISRAEL—*An Ancient* NATION *Reborn*

ISRAEL. At midnight, May 14, 1948, Great Britain's mandate over Palestine came to an end. In the Hebrew calendar that date was the fourth day of Iyar. At 4:00 P.M. on that day, while the last British forces were embarking at Haifa, the Jews held a solemn ceremony in the Tel Aviv Museum of Art. They rose and sang *Hatikvah,* the national anthem.

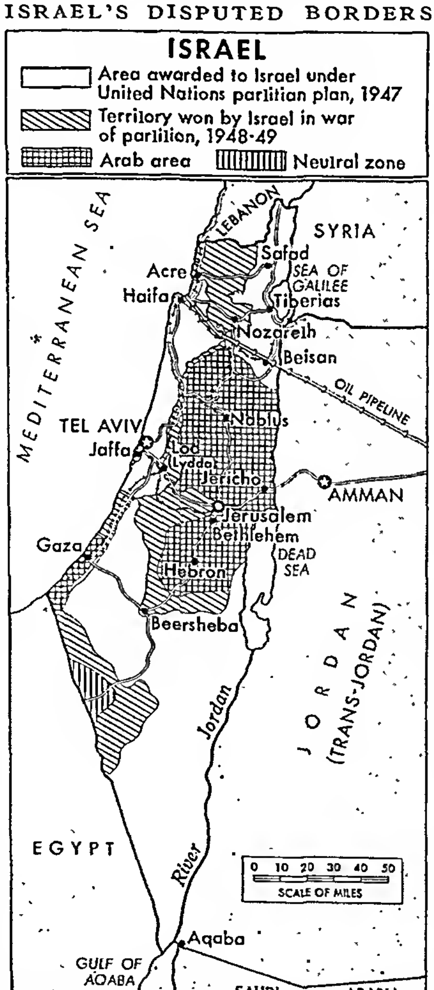
Then David Ben-Gurion, provisional prime minister, read the Israeli Declaration of Independence:

> . . . we, members of the council of the nation, representatives of the Jewish Community of . . . Israel and of the Zionist Movement, are here assembled on the day of termination of the British Mandate over the Land of Israel and, by virtue of our natural and historic right and on the strength of the resolution of the United Nations General Assembly, hereby declare the establishment of a Jewish State . . . to be known as the State of Israel.

The ceremony marked the fulfillment of an age-old dream. For the first time in nearly 2,000 years the Jews were to live under their own government in the land that was the birthplace of the Jewish people. The name *Israel* ("God strives") was borne by their ancestor Jacob and the 12 tribes descended from him. Throughout the centuries of the *Diaspora* (dispersion), Jews continued to refer to Palestine as *Eretz Yisroel,* "the land of Israel."

The new state had no definite boundaries. The United Nations had proposed in November 1947 that Palestine be split into separate Arab and Jewish states (*see* Palestine). It was recommended that the Jewish state occupy: (1) a narrow strip of coast, including the ports of Haifa and Tel Aviv but leaving Jaffa and Acre to the Arabs; (2) most of the Negeb, a large arid tract in the south; (3) eastern Galilee, around the Sea of Galilee. A small area, including Jerusalem and Bethlehem, was to be placed under international control. The proposed Jewish state covered 5,579 square miles, about the area of Connecticut. The Jews accepted the United Nations plan. The Arabs opposed it and launched a war to block partition.

ISRAEL'S DISPUTED BORDERS



The United Nations proposed to divide Palestine into Arab and Jewish states. The Arabs fought the partition, but Israel won more land than was originally assigned to it.

The War of Partition

The war mounted in intensity. Both Arabs and Jews repeatedly ignored United Nations truce orders. When the Jews proclaimed their new state, the neighboring Arab states openly joined forces with the Palestinian Arabs. King Abdullah of Trans-Jordan sent in his Arab Legion to surround Jerusalem and block the road to Tel Aviv. Egyptian forces moved into the Negeb, in the south. Lebanon, Syria, and Iraq attacked the northern borders. The United Nations appointed a mediator, Count Folke Bernadotte of Sweden. He was assassinated Sept. 17, 1948, as he passed through the Jewish section of Jerusalem. The United Nations then named Ralph Bunche, a United States citizen, as acting mediator (*see* Bunche).

During the bitter fighting some 800,000 Arabs fled the country. Entire villages were destroyed. The refugees sought haven in the neighboring Arab lands, but they were received reluctantly. Most of them were forced to live in wretched camps.

The Arab forces could do little against the rapidly modernized Jewish army, the *Haganah.* The Israelis seized Jaffa; drove the Arabs out of Galilee; established a corridor to Jerusalem, where they held the "New City"; and ousted Egyptian forces from the Negeb. By January 1949, the Arabs were ready to admit that the new vigorous nation of Israel was firmly established. Bunche persuaded Egypt to sign an armistice in February 1949. Egypt's example was soon followed by Trans-Jordan and Lebanon, and in July by Syria. Israel then controlled 8,000 square miles. Egypt held the Gaza coast. Trans-Jordan occupied the rest of Arab Palestine, as well as the "Old City" of Jerusalem (*see* Jerusalem).

In December 1948, the United Nations appointed a conciliation

THE VICTORIOUS HAGANAH PARADES IN TEL AVIV

Crowds cheered from sidewalks, balconies, and roof tops when Israeli forces paraded on Army Day, 1948, to celebrate their victories. This holiday (July 17) commemorates the anniversary of the death of Theodor Herzl, founder of modern Zionism.

commission, made up of French, United States, and Turkish delegates. They were to oversee talks between Israel and the Arab states. One task of the commission was to assist the disputing nations in agreeing upon locations of borders. It was also to arrange for resettlement of the Arab refugees. About 100,000 Arabs had remained in Israel. They became Israeli citizens.

A Democratic Socialist Republic

In January 1949, Israeli citizens, Arabs and Jews, elected a parliament of 120 members. This parliament was called *Knesset* (Hebrew word for "assembly"). The largest party, *Mapai*, moderate socialist, won 46 seats. It favored gradual nationalization of selected key industries, leaving a wide margin for free enterprise and advocated giving Arab Palestine to Trans-Jordan. *Mapam*, the United Workers party, Marxian socialist, won 19 seats. It stood for rapid and complete nationalization of industry and closer relations with Russia. *Mizrachi*, the United Religious party (16 seats) wanted to build the state on Jewish religious law. *Heruth*, the Freedom party (14 seats), the former underground group *Irgun Zvai Leumi*, wanted Israel to take all Palestine as well as Trans-Jordan by force of arms. The Communist party won four seats. The remaining delegates belonged to seven minor parties. Three members of the Knesset were Arabs.

REGISTERING FOR THE POLLS

A wounded soldier, back from fighting in the Negeb, fills out a registration blank to qualify for voting in Israel's first national election in 1949.

David Ben-Gurion remained prime minister. Dr. Chaim Weizmann, one of Israel's founders, was inaugurated president. In December 1949, the United Nations voted to put the Jerusalem area under the rule of the Trusteeship Council. Israel at once moved some government offices from Tel Aviv to the New City in Jerusalem. It proclaimed Jerusalem the capital of Israel; but both the United Nations and the Arabs denied the validity of this action.

The United States gave Israel *de facto* recognition May 14, 1948, immediately after Israel's declaration of independence. Within a year 40 nations recognized the new state. In May 1949, it was admitted to the United Nations. The 1951 elections gave 45 seats to Mapai, 20 to the General Zionists, and 15 to Mapam.

Problems Confront the New Nation

Israel is a hot, dry land. The temperature averages 69°F. on the Mediterranean coast. Practically no rain falls from May to October. This makes irrigation of most summer crops a necessity. The country lacks coal and iron and many other industrial minerals. Some are being found in the Negeb.

During the 26 years under the British mandate, the Jews put in irrigation systems and set up 265 agricultural settlements, many of them of the *Kibbutz*, or communal, type. On the Mediterranean coast they built Tel Aviv, the most modern city in the Middle East. They established many small industries and produced bromine and potash from the salt water of the Dead Sea (*see* Palestine). Yet the Jewish homeland was far from self-supporting. The excess of imports over exports was made up by large contributions from Jews living abroad and from capital brought in by Jewish immigrants.

CHAIM WEIZMANN

One of the founders of the state of Israel and its first president.

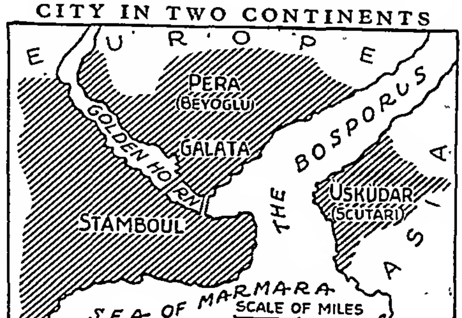
Britain had restricted immigration into Palestine. Immediately after independence, Israel opened its doors to Jews of all nations who wished to settle there. Immigrants poured in from the displaced persons camps in western Europe, from the Balkans, and from the island of Cyprus, where Britain had interned thousands. Many came also from the Middle East and even from North Africa. In the first year Israel admitted 200,000 immigrants, increasing its population by 30 per cent. During 1950 thousands of Asiatic Jews were admitted from Iraq and Yemen. The new arrivals were crowded into tent cities and barracks while the government worked desperately to provide permanent housing and employment for them. New agricultural settlements sprang up on the land vacated by the Arabs who had fled during the war.

In March 1949, the government proposed a four-year plan calling for thousands of new farm units, irrigation development, compulsory free education, social insurance, and a graduated income tax. To combat the high cost of living and to reduce imports, it adopted an "austerity" program—strict rationing, price control, and wage fixing. In 1953 a new 48-mile road was completed from Beersheba to Sdom. The road gave access to Dead Sea potash deposits.

The armistice was not followed by peace treaties. Border conflicts continued, and the Arab states refused to permit trade with Israel to be carried on through their territories. When Chaim Weizmann died, in 1952, Itzhak Ben-Zvi became president. Moshe Sharett succeeded the first premier, David Ben-Gurion, in December 1953. Population 1952 est.), 1,600,000.

ISTANBUL, TURKEY. No city has a more strategic position than Istanbul, formerly called Constantinople. It commands the narrow gateway between the Black Sea and the Mediterranean. Along its waterfront must pass all the southbound cargoes from European Russia and from the Danube Valley. Here too is the ferry crossing for rail-borne traffic between Europe and the Near East. The Bosporus—that narrow strait where Europe and Asia face each other—is little more than a mile wide at this point. To the south lies the Sea of Marmara, and 160 miles away the Dardanelles open out into Mediterranean waters (*see* Black Sea; Bosporus; Dardanelles).

CITY IN TWO CONTINENTS



This map shows Istanbul's strategic location. Üsküdar, in Asia, Stamboul, Galata, and Pera, in Europe, are all under one city government.

From 1453 to 1923 Istanbul was the capital of the Turkish Empire, and before that of the Byzantine Empire (*see* Turkey; Byzantine Empire). After the decline of Turkish might in the 19th century, the Turks were permitted to remain in possession of this strategic location because none of the European powers was willing to see it pass into the hands of a strong rival. But its critical position remained a constant threat to its security. When Kemal Atatürk set about forming a modern nationalist Turkish state, he moved his capital to Ankara, on the highlands of Asiatic Turkey.

Ancient History

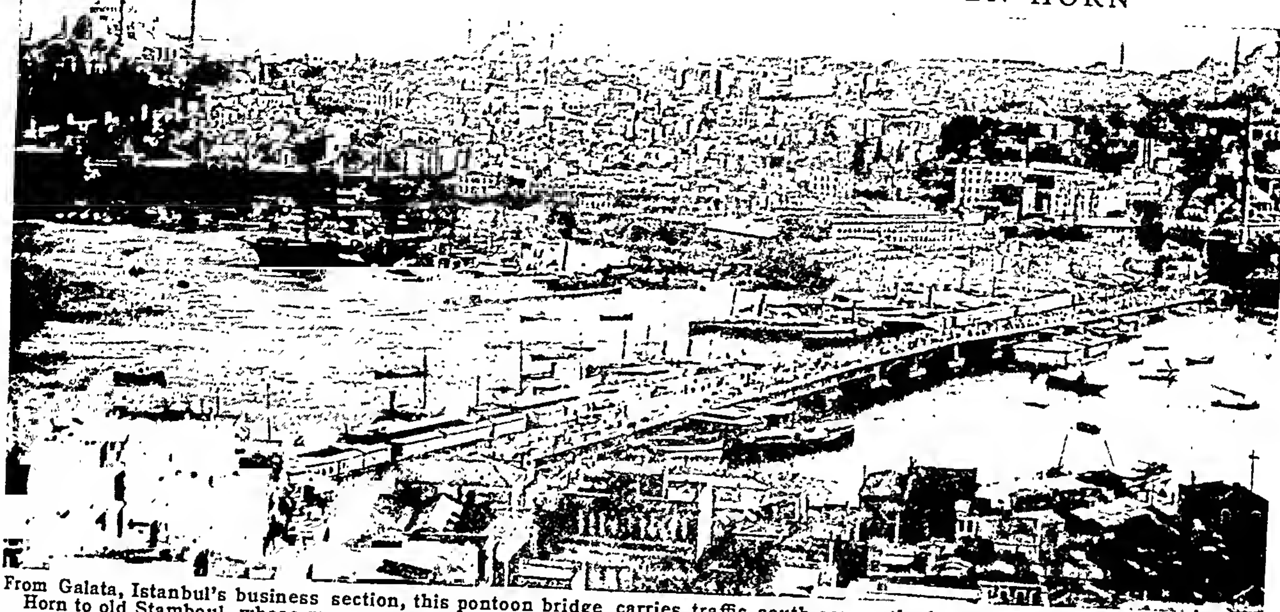
There has been a settlement on the site of Istanbul since prehistoric times. The five-mile long inlet from the Bosporus, now called the Golden Horn, provided an attractive safe harbor. About 667 B.C. seafaring Greek colonists from Megara took possession of the place and called it Byzantium. Nearly a thousand years later, the Romans under Constantine the Great captured the city, enlarged and beautified it, and strengthened its fortifications. In A.D. 330 Constantine gave it his name and made it the capital of his empire. It continued as the capital of the Eastern Roman Empire (Byzantine Empire) until the Ottoman Turks captured it in 1453. They transformed it into a rich and colorful Mohammedan city, drawing its wealth from the trade that passed through its gates.

Istanbul has many beautiful ancient buildings. Most famous is massive-domed Santa Sophia, which was a Christian church for nine centuries and a Mohammedan mosque for nearly five. It is now a museum. Facing it stands the beautiful Sultan Achmet, also called the Blue Mosque (*see* Architecture). The historic seat of the Ottoman sultans has been turned into an art museum; and the former war offices house the University of Istanbul. On the Bosporus, the 15th-century fortress of Rumeli Hissar stands next to Robert College, an American school.

The city today is important as a port and trading center. Its industries include cement, tobacco, and munitions factories, shipyards, and automobile assembling plants. Rugs and embroideries are made by hand.

Istanbul is divided into a number of separate communities. Old Stamboul, the original city

THE MAGNIFICENT HARBOR ON THE "GOLDEN HORN"



From Galata, Istanbul's business section, this pontoon bridge carries traffic south across the busy harbor waters of the Golden Horn to old Stamboul, whose mosques and minarets recall its many centuries as the capital of the powerful Ottoman Empire.

site, lies south of the curving Golden Horn. To the north of the Horn, Galata is the business section and Pera is the foreign residential quarter. Uskudar and its suburbs, across the Bosporus, form a shipping terminus and textile manufacturing center. Population (1950 census), 1,000,022.

The Sonorous ITALIAN TONGUE, *Beloved of Poets*

ITALIAN LITERATURE. The Italian language is a daughter in the direct royal line from ancient Latin, and resembles her the most of all the Latin descendants. The sonority and rhythm which French has lost, the delightful clearness which has become a bit blurred in Spanish, all remain in melodious Italian, the ideal language of poetry, in which it has always excelled.

DANTE

Yet modern Italian, being to a large extent a forced bloom, suffers in many respects from its artificial growth. For in the Middle Ages, while literary Latin of a sort continued to be used as the learned and cultured language, the mass of the people of Italy, mingling the old Low Latin of popular speech with imported foreign elements, contrived to swing it into a score of different dialects. Then came the great Dante, who selected the dialect of Tuscany for his literary work, and revealed its strength and beauty in his epic masterpiece, 'The Divine Comedy'. Petrarch and Boccaccio followed him, and wrote immortal lines in Tuscan—epic verse especially in the one case and prose stories in the other. Thus this dialect became the fixed literary language of Italy, and is today so recognized.

But the many other dialects still exist, and their words tend to creep in, not always elegant or well conceived; and it is here that the struggle between the classic but often cramped Tuscan and the cruder, but more vigorous popular dialects places the Italian writer at a loss. This artificiality and limitation of Italian, in spite of its rich sweetness, is therefore to be reckoned with in explaining why Italian writers of all times, and especially at present, are not as numerous as in other countries. But it has with equal truth been said that "Italian writers must be weighed, not counted." If they have been few, they have also been very great.

PETRARCH

Latin long remained in Italy more nearly a living tongue than elsewhere, and hence a written literature in the vernacular or people's language was slow in arising. Indeed, it was not until the last half of the 13th century, when the amazing figure of Dante emerged, that any truly Italian literature appeared.

Late as it was in starting, this literature attained its greatest glory almost immediately, far outshining all other literatures of the period. Dante (1265–1321) wrote his 'Divine Comedy' a century before Chaucer and three centuries before Shakespeare.

Petrarch (1304–1374) followed with his immortal sonnets to "golden haired" Laura, and Boccaccio (1313–1375) with his famous collection of prose stories entitled 'Decameron'.


BOCCACCIO

But with the great revival of interest in the ancient Greek and Latin literatures, which was also a feature of the Renaissance, the new Italian literature declined. The brightest spirits sought their inspiration in antiquity and the newly formed Italian tongue suffered through an affected and elaborate striving for Latin elegance.

It was not until the 16th century that Italian writers returned to a natural and spontaneous style. This century has been called the "golden age of Italian literature," not because it produced men of supreme greatness, but because of the large number of pleasing and competent writers who appeared. The best known of those are Ludovico Ariosto, whose masterpiece 'Orlando Furioso' overshadowed all the other romantic poems with which previous centuries had been flooded, and Torquato Tasso, whose 'Jerusalem Delivered' is a reaction against the worldliness of religion in his time, expressed in thunderous verse.


D'ANNUNZIO

During the 17th century and the first half of the 18th, Italian literature suffered from a grandiose style and emptiness of ideas. But in the second half of the 18th century Count Vittorio Alfieri, with his tragic plays, awakened Italy to a sense of her literary shallowness and also raised a wave of Italian patriotism.

As the impulse for a free Italy grew, there rose a vigorous new literature in the 19th century, the era when Italian national unity was won. Vincenzo Monti sang the conflicting sentiments of the early period. Alessandro Manzoni, who wrote the famous poem 'The Fifth of May' on the death of Napoleon and the novel 'The Betrothed', founded a romantic school frankly based on an imitation of the popular Sir Walter Scott. However, with the awakening of Italian national consciousness came a reaction against the imitation of foreign literature. New writers began to see Italy with new eyes. Giosuè Carducci in verse, and Matilde Serao and Antonio Fogazzaro in prose, wrote of Italy and things Italian, with a really indigenous point of view.

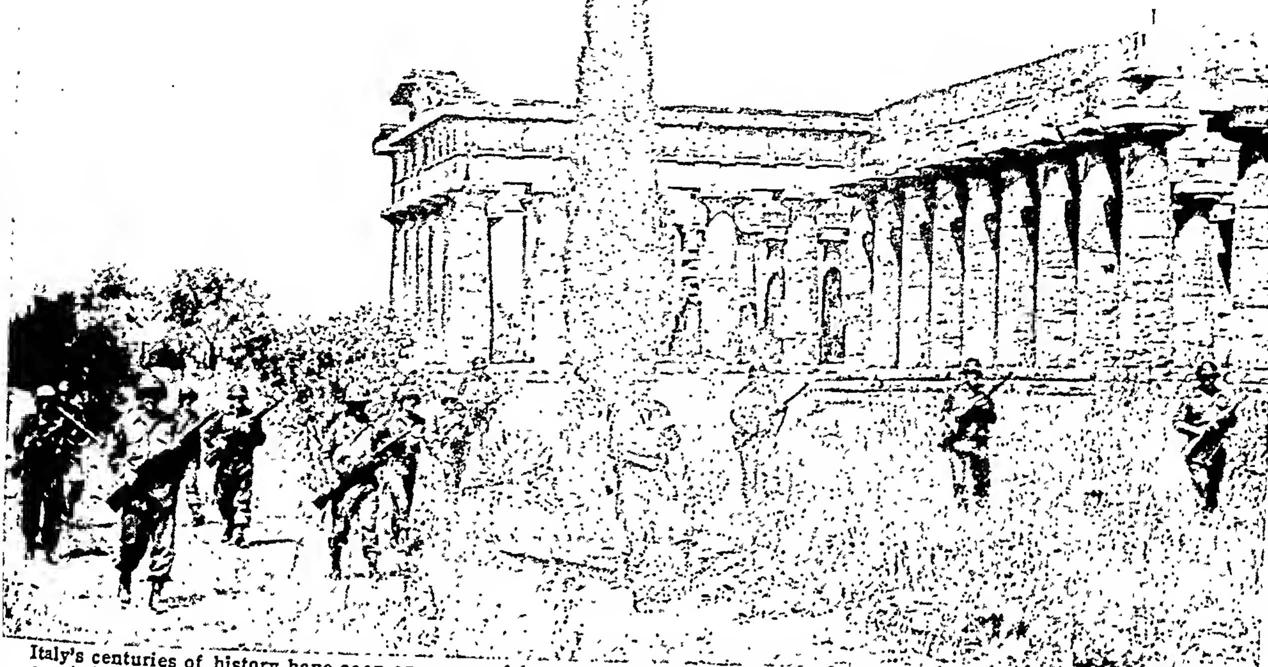

TASSO

Overshadowing all other Italian writers in the first quarter of the 20th century was the figure of Gabriele D'Annunzio. He was famous as poet, novelist, and dramatist before the first World War. His exploits as a flier during the war added immensely to his popularity. Of more recent renown are Luigi Pirandello, Sem Benelli, Giovanni Papini, and Benedetto Croce. Pirandello's 'Six Characters in Search of an Author' has been widely translated and was successful in America. (For Reference-Outline and Bibliography, *see* Language and Literature.)

PROMINENT FIGURES IN ITALIAN LITERATURE

Dante Alighieri (1265–1321), epic poet—'Divina Commedia' (The Divine Comedy); 'Vita Nuova' (The New Life).
Francesco Petrarch (1304–1374), poet—Sonnets.
Giovanni Boccaccio (1313–1375), poet and writer of prose tales—'Decameron'.
Ludovico Ariosto (1474–1533), epic poet—'Orlando Furioso'.
Torquato Tasso (1544–1595), epic poet—'Aminta'; 'Gerusalemme Liberata' (Jerusalem Delivered).
Giovanni Battista Marini (1569–1625), poet—'L'Adone'.
Carlo Goldoni (1707–1793), comic dramatist—'La Bottega di Caffè' (The Coffee House).
Giuseppe Parini (1729–1799), poet—'Il Giorno'.
Carlo Gozzi (1722–1806), dramatist—'Turandot'.
Vittorio Alfieri (1749–1803), dramatist—'Saul'; 'Oreste'; 'Virginia'; 'Timoleone'.
Vincenzo Monti (1754–1828), poet and dramatist—'Aristodemo'; 'Bassevilliana'.
Alessandro Manzoni (1785–1873), poet and novelist—'Il Cinque Maggio' (The Fifth of May); 'I Promessi Sposi' (The Betrothed).
Giacomo Leopardi (1798–1837), poet—'La Ginestra'.
Giosuè Carducci (1836–1907), poet—'Hymn to Satan'; 'Odi Barbare' (Barbaric Odes).
Antonio Fogazzaro (1842–1911), novelist and poet—'Miranda'; 'Leila'; 'Daniele Cortis'.
Giuseppe Giacosa (1847–1906), dramatist—'Come le Foglie' (Like Falling Leaves); 'Tristi Amori' (Hapless Love).
Giovanni Pascoli (1855–1912), poet—'Poemetti'; 'Le Odi e gli Inni'.
Matilde Serao (1856–1927), novelist—'Il Paese di Cuccagna' (The Land of Cockayne).
Roberto Bracco (1861–1943), dramatist and novelist—'Piccolo Santo' (Little Saint); 'Donne'; 'Maternità'.
Alfredo Panzini (1863–1939), biographer and critic—'Le Fiabe della Virtù'; 'Piccole Storie del Mondo Grande'.
Gabriele D'Annunzio (1863–1938), poet, novelist, dramatist—'Fedra'; 'Il Ferro'; 'Forse che sì, forse che no'; 'Canzoni della Gesta d'Oltremare'.
Benedetto Croce (1866–1952), philosopher—'Problemi di Estetica'.
Luigi Pirandello (1867–1937), dramatist—'Sei Personaggi in Cerca d'Autore' (Six Characters in Search of an Author).
Grazia Deledda (1875–1936), novelist—'La Madre' (The Mother).
Giovanni Gentile (1875–1944), philosopher—'Discorsi di Religione'; 'Il Concetto del Progresso'.
Sem Benelli (1877–1949), dramatist—'Cena delle Beffe'.
Giovanni Papini (1881–), critic—'Storia di Cristo' (Life of Christ); 'Un Uomo Finito'; 'Stroncature'.
Negri, Ada (1870–1945), poet—'Maternità'; 'Il Dono'.

ITALY—
Its Great HERITAGE *and Troubled* HISTORY



Italy's centuries of history have seen one wave of invaders after another sweep over the land. Here the old story is being enacted once more as American soldiers engage in mopping-up operations in Paestum near Naples in the second World War. They pass the ruins of the temple of Neptune (or Poseidon) built by early Greek invaders who conquered and settled this region about 540 B.C. The town withstood Hannibal's attack, but was later sacked by the Saracens and the Normans.

ITALY. The mountain-ribbed Italian peninsula has been the scene of some of the most dramatic chapters in all history. Here in ancient times Rome rose to world mastery. Here in the Middle Ages Venice, Genoa, and Florence attained their greatness and power. Here the art and learning of the Renaissance flowered and spread to awaken the continent of Europe. From this center the Roman Catholic Church extended its influence to every corner of the world.

Extent.—Greatest length, about 700 miles; greatest breadth: in north, about 350 miles; of peninsula, about 150 miles. Prewar area (with Sicily, Sardinia, and other islands), 116,226 square miles. Population (1951 census, preliminary), 47,020,536.
Natural Features.—Mountains: Alps and Apennines. Volcanoes: Mt. Vesuvius and Mt. Etna. Rivers: Po, Adige, Arno, Volturno, Tiber. Lakes: Maggiore, Lugano, Como, Iseo, Garda.
Products.—Agricultural: grapes, olives, lemons, oranges, and other fruits; wheat, corn, tobacco, oats, rice, barley, rye; tomatoes and other vegetables; sugar beets; dairy products. Manufactures: textiles (cotton, silk, rayon, and wool); wines, olive oil, sugar, clothing, leather goods, paper, steel, machinery, and automobiles; glass and pottery. Mining: sulfur, iron, zinc, lead, and marble. Fishing: tunny, sardines, and anchovies.
Cities.—Rome (capital, 1,606,739); Milan (1,264,402); Naples (1,003,815); Turin, Genoa (over 600,000); Palermo, Florence, Bologna, Venice (over 300,000); Catania, Bari, Messina (over 200,000); Verona, Padua, Taranto, Brescia, Reggio di Calabria, Leghorn, Cagliari, Ferrara (over 130,000).

Here, after the first World War, Fascism had its rise, and from here its doctrines spread to other countries, setting on foot a violent train of consequences that culminated in the second World War.

Yet despite the long and eventful history of the Italian peninsula, Italy *as a nation* is a newcomer, younger than the United States. It was pieced together in the 1860's from a group of minor states, and each retained its separate interests, traditions, and loyalties. The first World War weakened the nation. Brought into the war on the side of the Central Powers by an alliance with Germany, Italy broke this alliance and joined the Allied cause in 1915.

In the years that followed, Mussolini, founder of Fascism, tried to rouse the people with national slogans and weld them into a powerful unit which, with the aid of Nazi Germany, would obtain a great empire. But in the second World War as in the first the Italian people fought without enthusiasm. Mussolini was deposed, and Italy surrendered unconditionally to the United Nations. After the surrender, the lack of national unity hampered efforts at establishing a strong but representative government.

The Influence of Geography

The location of Italy accounts for the peculiar part it has played in world affairs. Thrust across the busy highway of the Mediterranean Sea, it occupied the very center of the ancient world and provided a bridge from the continent of Europe. A tremendous variety of people poured into the country from Mediterranean lands in ancient times. Later, barbarian hordes swept in from the continent of Europe. Isolated by the broken, mountainous character of the land, these various groups developed their own ways of life in separate communities.

At the northern end of Italy, the lofty Alps rise above the broad, fertile valley of the Po River. The rugged Apennines, from which short rivers flow east and west, extend down the center of the narrow peninsula to the tip of the toe.

The Italian peninsula pushes 700 miles southeastward into the Mediterranean. Sicily and Sardinia belong to Italy. Smaller islands, including historic Elba, are scattered along the coast.

Italy is a crowded country. The leg of the boot is narrow—from 100 to 150 miles in width. The full top of the boot measures little more than 350 miles across. All Italy, including islands, is only 116,226 square miles, less than New Mexico. And yet more than 47 million people live in this meager space.

The Alps and the Apennines

Italy is nearly covered with mountains. Look at its pattern on the relief map. On the north the steep and rugged Italian Alps lift a jagged, semicircular

WHEN CHRISTMAS COMES TO ITALY

A miniature of the manger of Bethlehem, called a *presepio*, is the center of most Italian homes at Christmas. Here a shopkeeper paints the setting in which he will place tiny figures of the Holy Family, the Wise Men, the shepherds, and the cows and sheep.

barrier against the rest of Europe. Here from deep narrow valleys rise peaks of more than 13,000 feet (*see* Alps). Where the Alps drop into the sea near the Gulf of Genoa the smaller Apennines begin (*see* Apennine Mountains). They run down the leg of the boot into the toe, filling with their spurs most of the peninsula. Italy's mountains are geologically "young" formations, the youngest mountains in Europe. They were uplifted in the Tertiary period, and many are of volcanic origin. As young mountains, their soil is packed loosely, and so washes away easily in erosion. Huge masses often shift and cause landslides.

HISTORIC NAMES

This map shows historic Italian regions. The names used by the Romans are in Roman type. Later names are in italic type. In the 8th century the name Calabria was transferred from the heel to the toe of the boot.

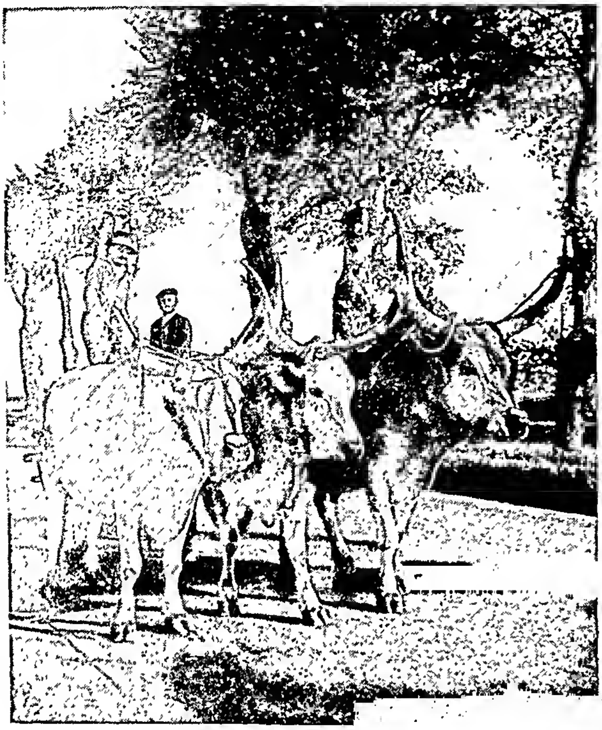
Scanty Natural Resources

Italy has little level, easily cultivated land. Plains in the peninsula are limited to a narrow coastal strip on each side of the Apennines and a few river valleys. Large-scale farming can be carried on only in the north, in the broad basin of the Po River, between the Alps and the Apennines. Only 41 per cent of the whole country is suited to cultivation, though about 50 per cent of the remainder consists of meadows, pastures, and woodland which help to support the rural population.

Mineral wealth is scanty. The country lacks the coking coal and petroleum so necessary for modern industrial development. The plunging mountain streams, however, have been harnessed to supply hydroelectric power to run factory wheels and railway trains.

Despite its long coast line, Italy draws little wealth from the sea. The waters of the Mediterranean are too warm for varied fisheries. Tunny and sardines are plentiful, but other fish must be imported from countries where cooler currents flow. Fine harbors are scarce. Some of the ports that helped bring commercial importance in ancient and medieval times have been blocked by silt. Italy has not been a first-rate naval power since the beginning of the age of steam.

HOW TUSCAN FARMERS LIVE AND WORK



Italy is not able to produce enough to support the large population. It must import more than it can export. Poverty has driven millions of its people to migrate to other countries.

How the People Live

About half the people live by farming this rugged land with its summer drought. They add level ground by terracing the slopes, and where possible irrigate the fields. The average family tills 7 to 20 acres. Most farmers are tenants who share their meager produce with the owner. Absent landlords own vast estates, called *latifundia*. In Sicily and the south, where bailiffs hire workers at low wages, farm machinery is rare. Oxen pull the crude plows and haul the produce to market. The wife and children must help the farmer with chores done in the slow, hard ways that have changed little since Roman times. The women weave lace, crochet raffia articles, and braid straw for hats to add to the family's tiny cash income.

Even the small children have their tasks. They watch the hogs or geese as they forage for food, or drive the sheep and goats to the rocky hillside pastures. They spread mulberry leaves on the racks where silkworms feed and spin their cocoons. They gather the twigs that burn so fast in the cooking fire and carry food and water to the workers in the fields. They do their share in the grape harvest in the early autumn, and when the hard work of making the wine is finished they join in festivals that originated hundreds of years ago.

Most Italian children spend but a short time in school. Compulsory elementary education laws are not enforced in the south, where villages are often too poor to support schools. A large number of the children attend Roman Catholic parochial schools. From one fourth to one fifth of the Italians cannot read or write. Specialized secondary schools train teachers and offer classical, scientific, and technical courses. Their attendance is small compared with enrollments in American high schools. Several famous Italian universities, such as those at Salerno, Bologna, and Padua, were founded in the Middle Ages.

Most farm folk live in towns and villages instead of scattered farmhouses. They drew together long ago in hilltop settlements for defense against hostile neighbors and to avoid the malaria that infested swampy valley farms. They have clung to this way of living because they are sociable people who enjoy chatting with their neighbors, joining in the singing and dancing and festivals in the village streets, and gathering for mass in the village church. Their rock and stucco houses stand flush with the winding streets. Gardens hide behind the houses.

Strong white oxen do the heavy work on many Italian farms. At the top, we see a team hauling produce to market after they have pulled the plow and harrow to cultivate the crops. The large farmhouse at the bottom may shelter three generations and have space on the ground floor for livestock. Its stucco coating has worn away, baring the brick and rubble wall.

Italian cities were laid out in ancient or medieval times by rulers whose chief interest was the grandeur of the plazas, monuments, churches, and palaces. The homes of the poor are likely to be tucked away in odd corners or packed together along narrow, sunless streets. The houses are four or five stories high, and the housewives save trips downstairs by lowering a basket on a rope to the pushcart peddler on the street. In southern cities the vendors of cooked foods and vegetables add to the noise and confusion in the narrow streets by ringing a bell and crying their wares. The stores are chiefly small specialty shops. Many

a jewelry or art store has kept the same location for centuries as the business has passed down almost unchanged from father to son.

Contrasts Among the People

The people of central and southern Italy are almost wholly of the long-headed, dark-eyed, black-haired Mediterranean stock. Gay and impulsive, they love music, play, and sociability. They are kindly, patient, and capable of great self-sacrifice on behalf of family or friends. Many are hard workers, though the climate makes sustained effort difficult.

The countless invasions from beyond the Alps have given the Po basin a more varied population. Taller, fairer folk with Celtic or Alpine round heads mingle with the Mediterranean types. With their greater perseverance and energy, these north Italians have produced most of the political and economic leaders.

The Varied Italian Climate

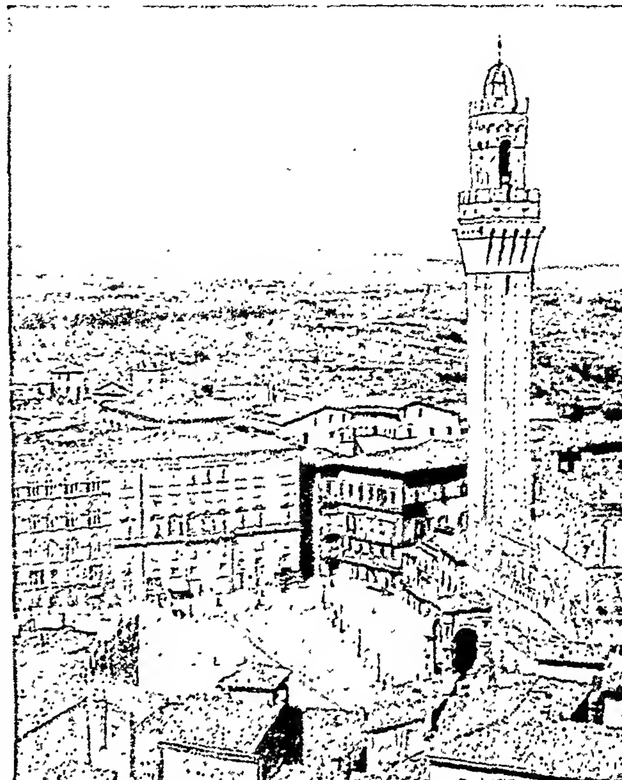
Italy lies in the same latitudes as the portion of the United States from Maine to Maryland. But the climate is far different.

The peninsula, flanked by warm seas, has the type of climate called *Mediterranean*, with dry summers and wet winters (*see* Climate). In summer, dry winds blow over it toward the Sahara in Africa and draw moisture from the land as they blow. Visitors enjoy a high percentage of sunny days. But the farmers do not regard this as a blessing, since crops lack water in the hot growing season. In winter, the prevailing wind is from the west and bears abundant rain. Heavy showers, or even deluges, often wash soil from the hillsides and cause destructive landslides.

In the north the climate is almost *continental* in type. The high snow-crowned Alps intercept much of the moisture from the westerly winds, but the plains usually get plenty of rain for crops, except in the extreme northwest. There, however, the abundant flow of the streams descending from the mountains provides ample water for irrigation. Cooler weather and frequent storms make the northern climate more stimulating to physical activity than does the warmer more placid climate of the peninsula.

Summer is hot throughout Italy. The average temperature in the Po basin in July is 76° F. In Sicily, seven degrees of latitude farther south, the average is 80° F. in the same month. Daytime temperatures in Sicily are very high, but the cool nights, characteristic of marine climate, lower the average. In winter there is a wider variation of temperature from north to south. In Turin the average is near the freezing point, while in Messina it is 53°F. High, mountainous regions are, of course, much cooler. The year-round warmth of the Mediterranean Sea tends to keep the temperature of coastal areas high.

SIENA—A HILL TOWN OF TUSCANY



Out of the public square of Siena rises the Gothic bell tower, 285 feet high. It was begun in 1289, during that medieval period when the people of so many Italian cities were free.

A FUEL VENDOR

This barefoot girl has come from the country to sell a load of brush for firewood. Coal is too expensive for most homes.

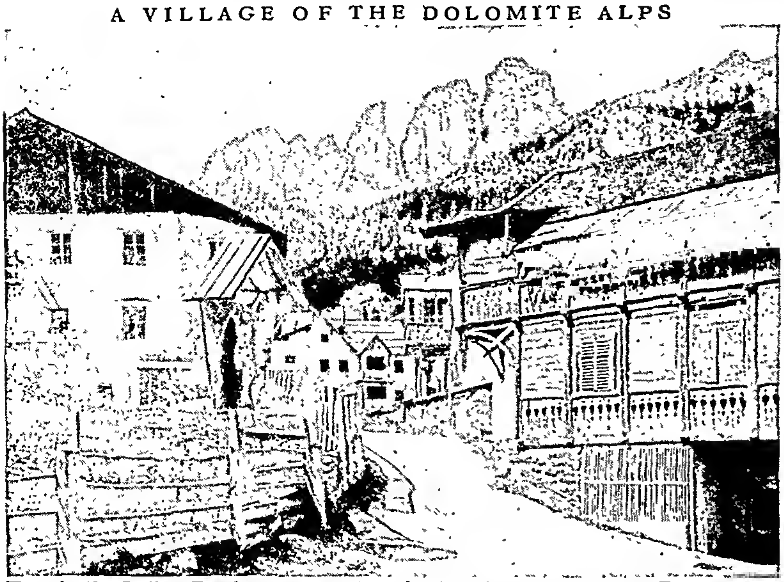
Northern, or Continental, Italy

"Northern Italy" has five regions—Piedmont, Lombardy, Venetia, Liguria, and Emilia-Romagna.

The Alps on the extreme northern border make a vital contribution to the prosperity of northern Italy, the richest part of the country. Tourists are attracted by the beauty of the snowy peaks and calm Alpine meadows and the row of lovely lakes that sparkle at the foot of the mountains—Lake Maggiore, Lake Como, Lake Garda, and Lake Lugano. Snow-fed streams wash soil from the mountainsides, renewing the fertility of the plain, and furnish water for irrigation. They also supply most of Italy's hydroelectric power, which is used by electric railways as well as factories.

Most of northern Italy consists of the Po River basin. The river rises in the western Alps and flows almost straight east to the Adriatic. The fertile valley that spreads on both sides of the

A VILLAGE OF THE DOLOMITE ALPS



Here in the Italian Tyrol wood and stone for building are plentiful. Towering in the background are some of the Dolomite peaks, fantastic shapes of weathered limestone. Notice the crucifix in the wayside shrine, so typical of Catholic Italy.

river is the most favored region in Italy. It covers less than one-fifth of the total area, but it is the center of Italy's agricultural and industrial life.

Here an energetic people practises intensive cultivation, using agricultural machinery, drainage, and irrigation to produce most of Italy's corn, rice, sugar beets, and hemp, and nearly half its wheat. Here too are pastured most of Italy's beef and dairy cattle. Mulberry trees feed the silkworms that produce Italy's raw silk. Orchards and vineyards climb the hills. Farmers often make triple use of each acre by training grapevines on the mulberry trees and growing wheat between the tree rows.

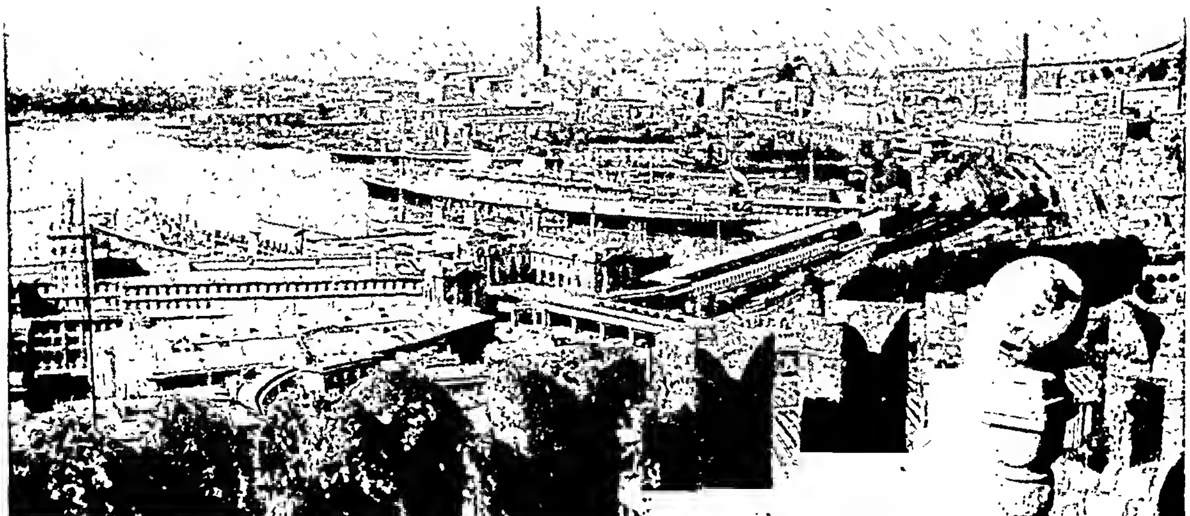
Draw a line from Genoa northwest to Turin, east through Milan to Venice, then southwest to Bologna and back again to Genoa. This line encloses the great industrial region of northern Italy, which produces four-fifths of the country's manufactures. Textile and metal industries are the most important. (*See* Genoa; Turin; Milan; Venice; Bologna.)

The narrow department of Liguria begins at the French border and circles the Gulf of Genoa. Its coast is known as the Italian Riviera. Rugged mountains rise from the steep and rocky shore, protecting it from cold north winds. Picturesque "double" villages climb the cliffs. Fishermen's homes, close to the sea, form the "lower" village. In the "upper" village live the farmers, who grow fruit trees and grapevines on narrow, high terraces. Flowers are raised for the perfume industry. Hotels built on sites of great beauty welcome winter visitors.

The Apennines and the Interior Uplands

Central and southern Italy consist of the broad mass of the Apennines running down the middle of the peninsula with coastal plains on each side. The Adriatic side of these mountains is steep, the coastal plain narrow. The west slope is gentler and wider.

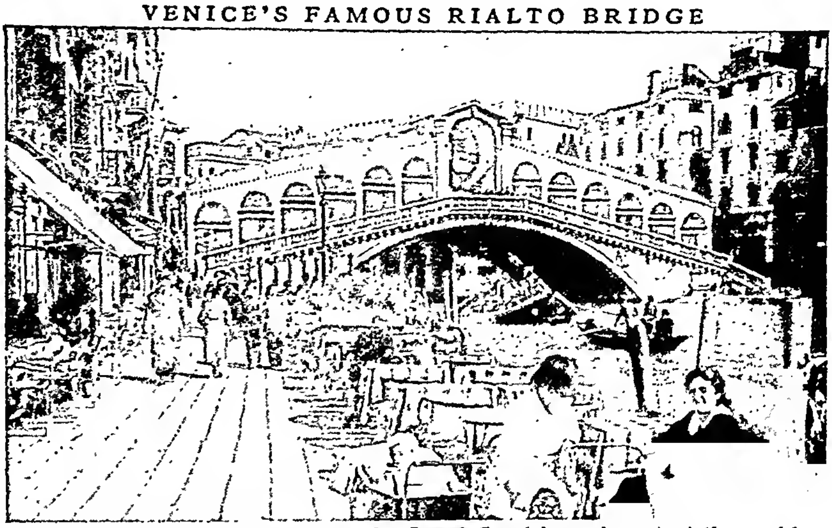
GENOA, SEA GATEWAY FOR THE INDUSTRIAL NORTH



We look out over the historic harbor of Genoa. Here Columbus dreamed of far voyages. Through the years the harbor has been enlarged and deepened. Its modern docks accommodate the greatest ocean vessels. Ships from all parts of the world bring raw materials to be freighted by rail to industrial northern Italy, Switzerland, and southern Germany.

The interior uplands are rough, rocky, and often lacking in fertility; yet they support a considerable population. Farmers grow cereals, grapes, and olives in the interior valleys. They pasture sheep and goats on the high slopes, taking their flocks to the plains when snow covers the mountains in winter. Where the rainfall is sufficient the heights bear scanty woodlands. They furnish wood and charcoal for fuel, and nuts to add to the food supply. Umbria lies wholly within the uplands. It is the only region in the peninsula without a coast line.

VENICE'S FAMOUS RIALTO BRIDGE



This graceful marble bridge across the Grand Canal is an important thoroughfare today just as it was three centuries ago when Shakespeare spoke of it in 'The Merchant of Venice'. Notice the gondola in the canal followed by a freight barge.

West Coast and Toe of the Boot

Moving down the western coast of the peninsula, we pass in succession through Tuscany, Latium, and Campania facing the part of the Mediterranean which is called the Tyrrhenian Sea. Calabria fills the toe of the boot, and Lucania the instep.

The coastal plain of Tuscany is marshy and malarial, but the hills are fruitful. The heart of this historic region is the Arno River valley, fertile and densely populated. Grain fields, vineyards, and fruit orchards flourish in the countryside and the cities are busy with manufacturing and commerce. The wealth of this valley created the famous city of Florence (*see* Florence). Pisa was the chief port of Tuscany until its harbor was silted up by the Arno. Now its place has been taken by Leghorn (Livorno) (*see* Pisa).

In the interior stand ancient hill towns, built high on the ridges for protection and health. The crests of the Tuscan hills are clothed with forests, and on their fertile slopes grow mulberry and olive trees, and the grapes from which the renowned Chianti wine is made.

Latium, south of Tuscany, includes the Tiber River valley and surrounds the great city of Rome (*see* Rome; Tiber River). This valley, called the *Campagna di Roma*, is not so productive as the Arno basin. Its ancient fertility was worn away by overcultivation and neglect. The flat coastal plains turned into worthless swamps, breeding-grounds for malarial mosquitoes. One of Mussolini's proudest achievements was the reclamation of the Pontine Marshes south of Rome covering about 175,000 acres. Millions of lira were poured into the work of digging a spiderweb of canals, clearing the land of scrub growth, breaking and fertilizing the soil, and building homes and towns for colonists. The Rockefeller Foundation helped with the task of ridding the region of malaria. By the time the reclamation project was completed in 1935, the newly created province of Littoria (now Latina) had a population of 200,000, which was producing fine crops of wheat, sugar beets, and vegetables.

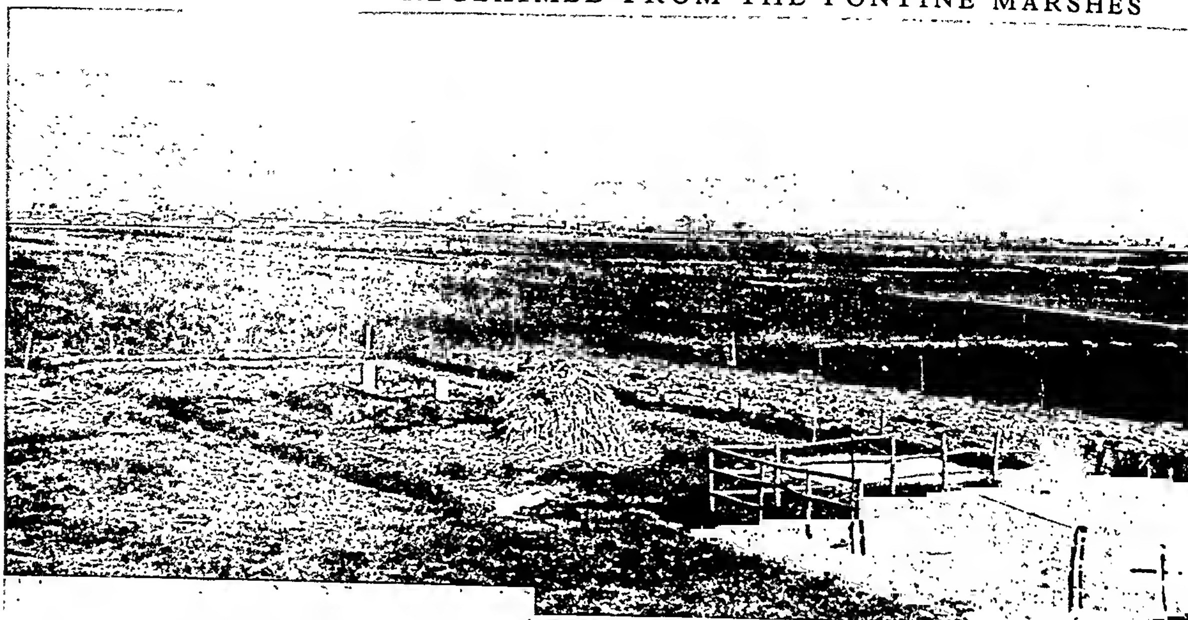
A FLOATING VEGETABLE STORE

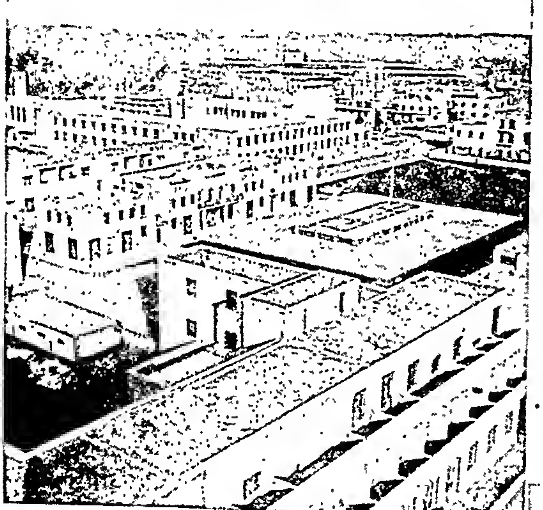
In Venice the familiar Italian peddler hawks his wares from a boat. Notice the primitive weighing scale he holds in his hand and his home-made wicker baskets.

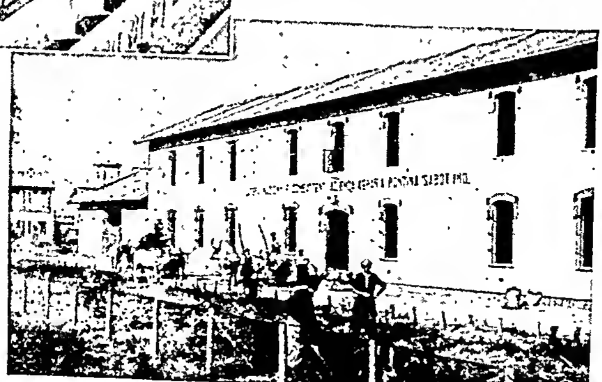
The extraordinary fertility of the area surrounding the Bay of Naples, in the region of Campania, is the gift of the volcanoes. South of Naples towers Mount Vesuvius, the world's most famous volcano (*see* Vesuvius). North of the city lie the Campi Flegrei, or "burning fields," in the crater of an extinct volcano where fumaroles still steam. On the volcanic soil the most crowded rural population of Europe grows abundant crops of cereals, fruits, vegetables, and hemp. The base and slopes of Vesuvius are covered with fields, vineyards, and orchards.

Naples is the second port of Italy, an important commercial city, and a center of tourist travel. The Bay of Naples is renowned for its beauty. Its south shore has been a pleasure resort since Roman times (*see* Naples). Sorrento and Castellammare here are picturesque modern resort towns. Pompeii and Herculaneum, at about the center of the east shore

RICH FARM LAND RECLAIMED FROM THE PONTINE MARSHES







This region of smiling farms and busy towns was part of the malarial Pontine Marshes until it was drained and colonized between 1930 and 1935. The town of Sabaudia (center) was built in 265 days. In the bottom picture, farmers are unloading their wheat crop at a coöperative granary in another new town, Latinia.

of the bay, were ancient resort cities which were buried by the eruption of Vesuvius in 79 A.D. and now draw tourists to their excavations (*see* Pompeii). Amalfi and Salerno were famous ports and trading centers in the Middle Ages. The first landing on the continent of Europe by American troops in the second World War took place on the beaches of Salerno.

In Lucania and Calabria to the south the mountains crowd down toward the sea. Steplike shelves on the mountainsides are the most densely populated parts of these districts, because the valleys are unhealthful. On these shelves are grown cereals, olives, and citrus fruits. Frequent earthquakes shake the bold and rocky ranges. Reggio di Calabria, across from Messina in Sicily, is the chief city and port.

East Coast and Heel of the Boot

On the Adriatic side of the peninsula, the Apennines lie so close to the sea that they leave only a narrow and regular coastal plain in the districts of the Marches and Abruzzi e Molise. The rivers are mountain torrents, and there are no good ports or fertile valleys. The mountains rob the winds from the Mediterranean of their moisture, and the dry land produces poor crops.

Apulia, which occupies the heel of the Italian boot, is a high plateau sloping toward the southeast. The fertile, chalky soil drains readily and allows the rains to flow away. Wheat, grapes, and olives are grown. Droughts are frequent and the crops often fail to feed the people who live there. An aqueduct was built from the Apennines to bring water 113 miles for irrigation. The chief towns are the ports of Bari, Taranto, and Brindisi. Monte Gargano, the mountain fragment that extends into the sea to make a spur for the boot, is a limestone block only partly forested. Its few inhabitants use it as a pasture for goats.

Agriculture, Industry, and Trade

Italy is predominantly a farming country. About half of the working population is engaged in agriculture. Most of the farm products are consumed at

home. Though wheat is grown on more than one-third of the arable land, Italy must still import wheat for bread and macaroni. Olives grow in all but the coldest sections and grapevines flourish everywhere, but the home demand absorbs most of the olive oil and wine. Citrus fruits are shipped abroad in large quantities. Spring vegetables go to colder countries.

Italy lagged behind the countries of western Europe in industrial development. One reason for this was the scarcity of coal. Iron also is scarce, though there are minor deposits in Tuscany and on Elba.

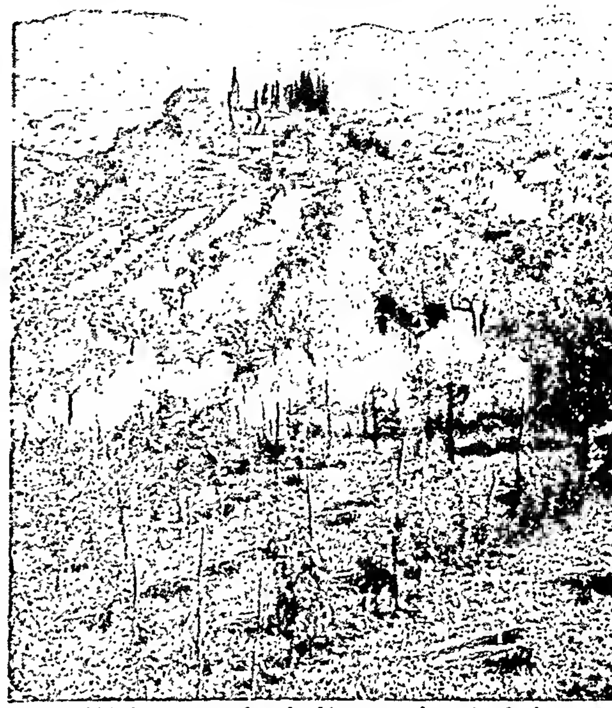
The most famous mineral product is Carrara marble, which has gone into beautiful statuary and handsome buildings in all parts of the world. Sicily and southern Italy have immense sulphur deposits. Mercury is found in the central Apennines. There are limited amounts of bauxite, zinc, lead, and manganese.

Lacking coal, Italy turned to the development of hydroelectric power from its many mountain streams. Its hydroelectricity output was the largest in Europe before the second World War. Postwar construction increased its capacity 45 per cent by 1952. Seventy per cent of the development was in the north because the drier southern hills do not furnish a year-round flow of water. Italian engineers learned to harness the energy of the fumaroles, or steam springs, in Tuscany and other volcanic regions.

Textile making is the leading manufacturing industry. Important metal industries were developed in the period between the World Wars in spite of the necessity for importing coal and a good share of the iron and other metals. Italian automobiles competed with American cars in the European market. Chemical manufactures also multiplied.

The country regularly imports more goods than it can export. Funds sent home by emigrants and money spent by tourists help to lower the foreign trade deficit. The chief exports are cotton, silk, rayon, and wool fabrics; raw silk and rayon; fruits, tomatoes, cheese, and nuts; automobiles; wines. Leading imports are coal, raw cotton, wheat, iron, steel, and other minerals; wood pulp, raw wool, petroleum, machinery, and vegetable oils.

GRAPES AND GRAIN FROM THE SAME FIELD

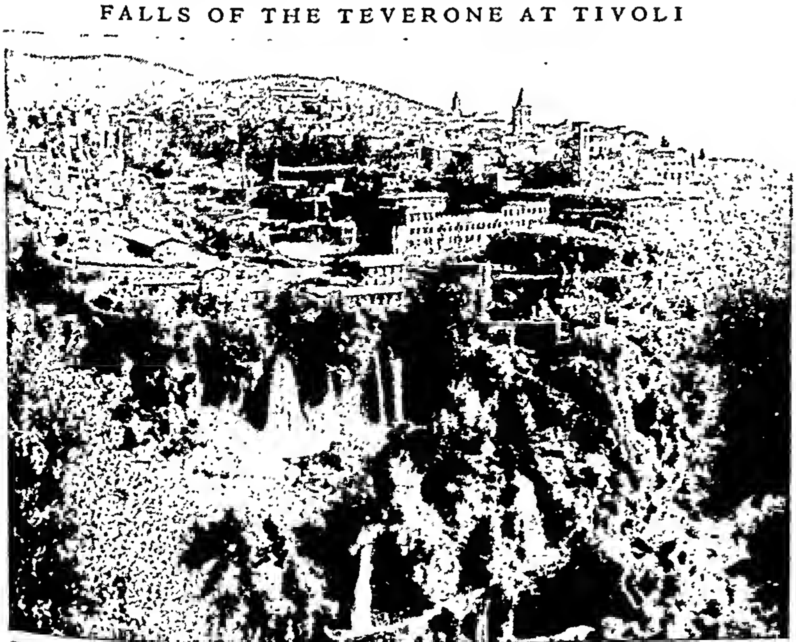


Italian hill farmers make double use of each sloping acre. Between rows of grapevines they plant grain, and so get bread and wine from the same soil.

A spiderweb of railways connects the ports and mountain passes of northern Italy with the cities of the interior plain, and a few of these lines are continued south as far as Rome. The peninsula for the most part is not so well served with railways as is the north. Railways edge the coastal plain, outlining almost the entire boot; but few lines cross the mountains, so that districts on opposite sides of the peninsula are usually isolated from one another. Most of the railways, particularly in the north, are electrified. Although many new highways were built during the Fascist régime, the old Roman roads, re-surfaced, still form the chief arteries in the highway system.

(The Italian islands of Sicily and Sardinia are treated in separate articles.)

FALLS OF THE TEVERONE AT TIVOLI

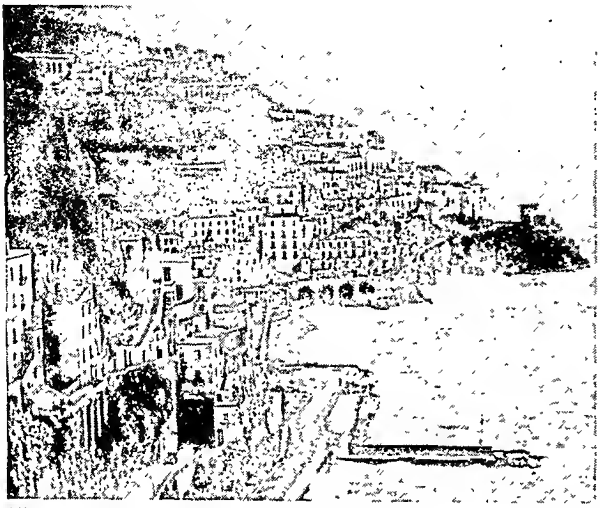


The cataracts of the Teverone (ancient Anio) and the gorge into which they plunge have helped to create the renowned beauty of the Tivoli region. Today these cataracts also supply hydroelectric power for Tivoli and for Rome, 18 miles away.

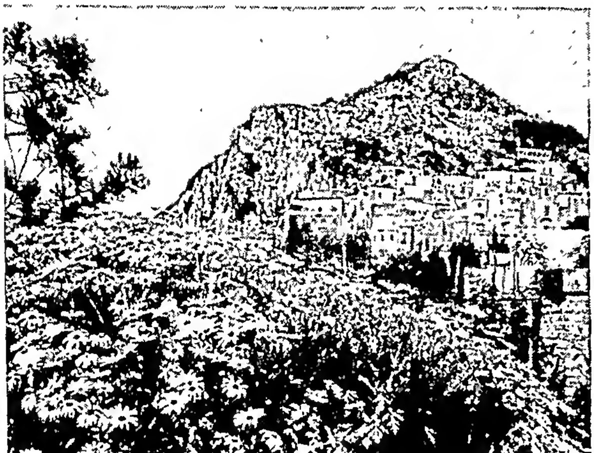
History of Italy

In the long centuries of Italy's history, one region after another has held first rank. The foot of the boot and Sicily became Greek colonies and centers of Hellenic civilization in the 8th century B.C. Remains of their beautiful temples, theaters, and city

OVERLOOKING THE GULF OF SALERNO



The white villas of Amalfi cling to a lofty promontory rising above the blue waters of the gulf. Amalfi Drive, cut from the cliff here, affords breath-taking views along the north coast.



The town of Capri perches amid the hills on the beautiful isle of Capri. This picturesque island lies off the point that separates the gulf from the Bay of Naples.

The port of Salerno occupies the head of the gulf. On the beaches north and south of the town American forces fought their way to a landing in the second World War.

walls still stand. In Tuscany, the Etruscans made early advancements in the arts and conquered neighboring peoples until they held a large part of the peninsula (*see* Etruscans). Then the Latin farmers, settled on seven hills near the Tiber, rose to supremacy and extended their power until Rome ruled the ancient world (*see* Roman History). After the Roman emperors moved to Constantinople in A.D. 330, the Western Roman Empire decayed and was overrun by waves of barbarians (*see* Alaric; Goths; Huns; Lombards; Vandals). Political unity was shattered as rival rulers fought over fragments of Italian territory.

Even Charlemagne, who had conquered the Lombard rulers and had himself crowned emperor in Rome in A.D. 800, could not check disintegration (*see* Charlemagne). He allied himself with the papacy and confirmed the pope's rectorship of cities taken from the Lombards. This was the beginning of the temporal sovereignty of the popes and added another power to those struggling for supremacy. Charlemagne's Holy Roman Empire fell apart after his death. It was refounded by the Saxon Otto I in 962, leaving Italy in nominal union with Germany. When Frederick Barbarossa attempted to assert his imperial rights in Italy in the 12th century, his advance was checked by a league of Lombard cities; and these cities won the right of self-government (*see* Holy Roman Empire; Frederick).

In the south, Sicily and southern Italy had been conquered by the Moslems, or Saracens, in the 9th century. Adventurers from Normandy gained control here in the 11th century. As the Kingdom of the Two Sicilies and the Kingdom of Naples, the region was a pawn of warring foreign princes.

In the north, the city-states grew in wealth and power. They came to dominate the countryside while feudalism declined. They drew their riches from the produce of their fertile river valleys and from profits on commerce between the Orient and Europe. This trade flowed in by way of Venice and passed through other northern cities on its way across the Alps. Florence, Venice, Milan, and the papacy became the strongest of the contending powers. The influence of the popes waned between 1305 and 1377 when the seat of the papacy was in Avignon, France.

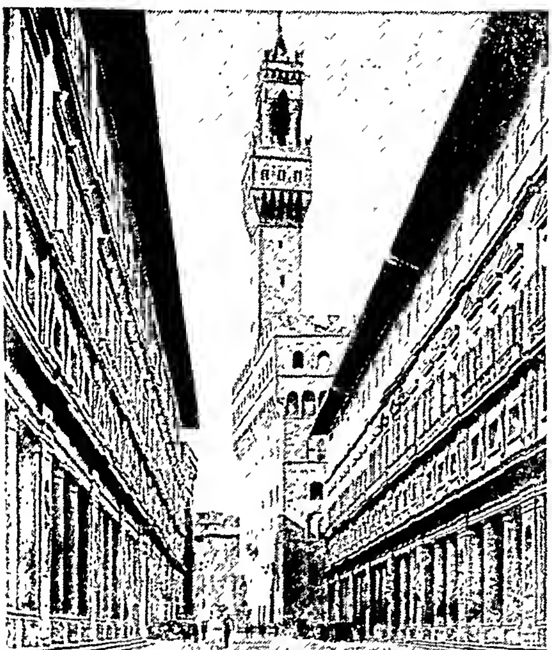
The Italian Renaissance

Under the patronage of the papacy and of such wealthy and autocratic princes as the Medici of Florence, the scholars, writers, and artists of the city-states created the masterpieces of literature, art, and science that made the Italian Renaissance one of the most influential movements in history (*see* Renaissance; Medici). In this period were built splendid churches, palaces, and public buildings that are the admiration of the world. The beautiful cities were, however, filled with strife. Nobles took sides in the feuds of the Guelf and Ghibelline parties, and the cities fell under the rule of despots (*see* Guelfs and Ghibellines).

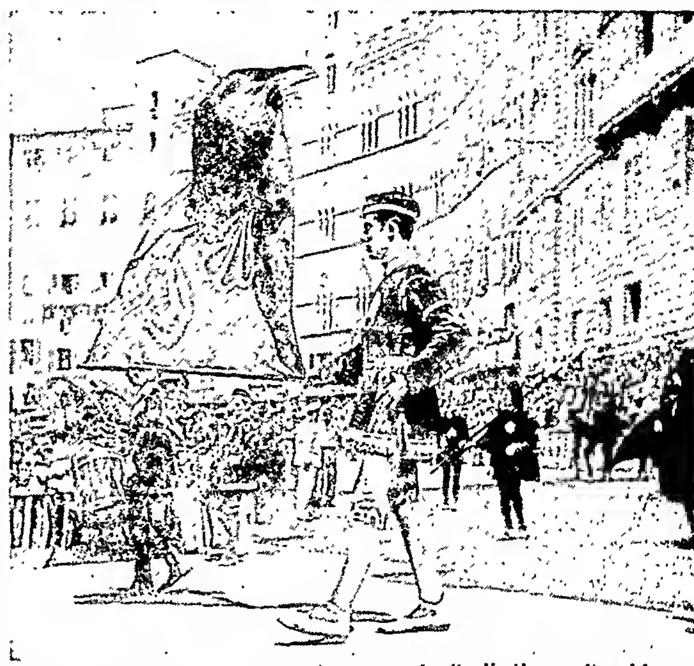
The rugged land of Italy lent itself to the growth of small states separated by mountains and rivers.

NATURAL BEAUTY AND MEDIEVAL SPLENDOR IN ITALY

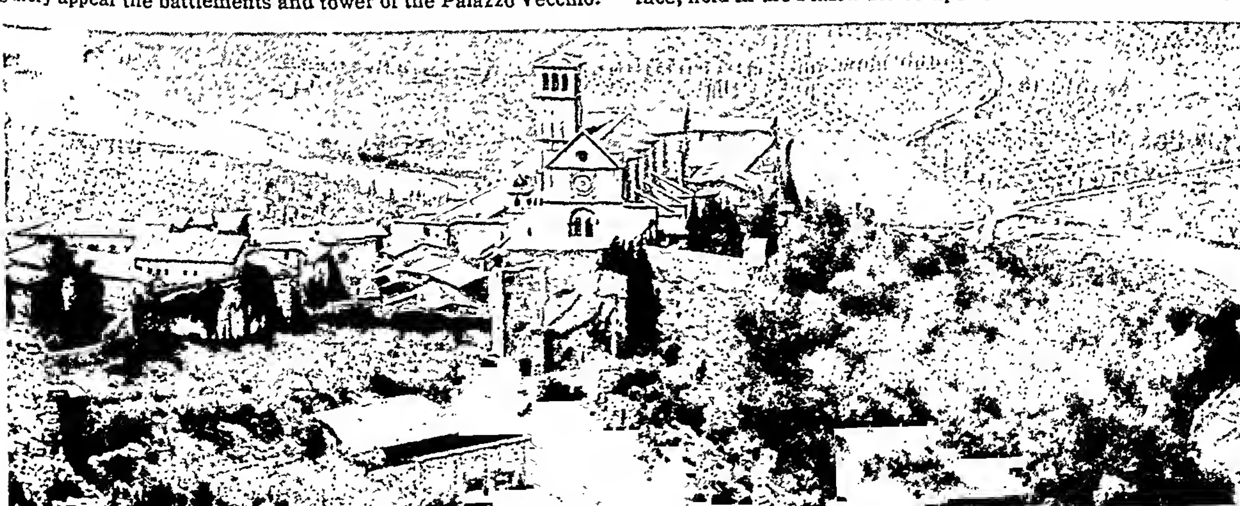
Here the Alps look down on Lake Maggiore, largest of Italy's slender, mountain-girt northern lakes. Offshore lie the Borromean Islands. On Isola Bella, at the right, rise the palace and elaborate terraced gardens, residence of the Counts Borromeo.



Between the two wings of Florence's famous Uffizi Palace and gallery appear the battlements and tower of the Palazzo Vecchio.



Flag-waving and processions start the "palio," a medieval horse race, held in the Piazza del Campo in Siena twice each summer.



At Assisi the Gothic church of San Francesco caps a mountain spur overlooking Umbrian orchards and vineyards. It is a double church, one structure rising above the other. In the crypt lies the body of Saint Francis, Assisi's most famous son.

The people thought of themselves as Florentines or Venetians rather than Italians, and their patriotic loyalty went to their city or duchy. The tiny republic of San Marino in the northeastern Apennines has remained through the centuries as a relic of this period. Though its 38 square miles are entirely surrounded by Italian soil it is nominally independent of Italy and claims to be the oldest state in Europe.

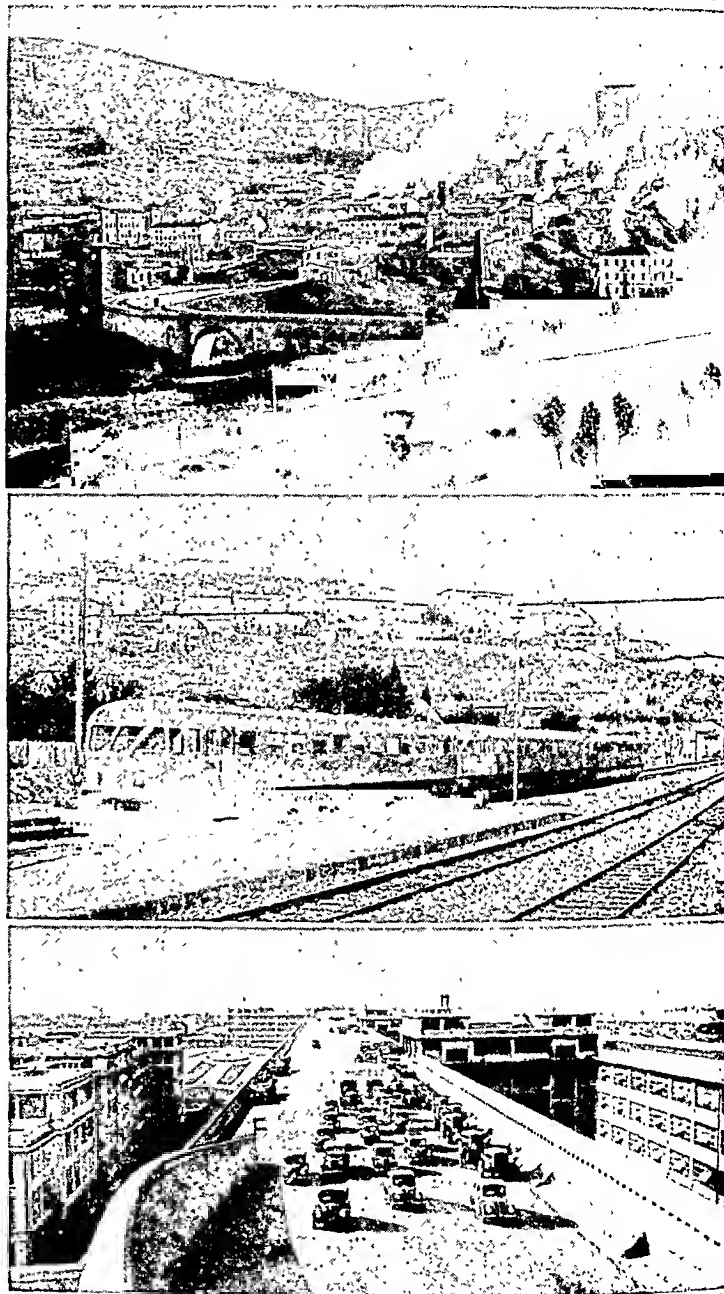
Pawn of Strong Neighbors

While Italy was torn by dissension between petty dukes and the papacy, strong nations developed in other parts of Europe. Their ambitious kings sought to conquer this defenseless land. The epoch of French and Spanish rivalries over Italy began with the triumphal raid of Charles VIII of France through the peninsula to Naples in 1494 (*see* Charles VIII, in article Charles, Kings of France). By 1544 Charles I of Spain had three times defeated the French and had won recognition as ruler of Sicily, Naples, and Milan (*see* Charles V, Holy Roman Emperor).

For centuries the states of Italy were pawns, passing from one to another of Europe's rulers by war, marriage, death, or treaty. The papacy was strong enough to protect its temporal power over large areas in central Italy. When the Turks cut the trade routes to the East many of the city-states fell into decay and passed under foreign rule. The ill-governed, heavily taxed people had no voice in their transfer.

With the outbreak of the French Revolution, democratic ideas found a response in some communities, and these aided Napoleon in his conquest of the country (*see* Napoleon I). Italy was more nearly united in Napoleon's empire than it had been since the fall of Rome. Even Rome and the other papal territories were included in Napoleon's kingdom. After his defeat most states went back to their previous sovereigns. The rule of the Austrians in Lombardy and Venetia and that of the Spanish in Naples and Sicily were especially harsh.

DEVELOPMENT OF POWER AND TRANSPORTATION



Steam springs, called fumaroles, or *soffioni*, are the basis of the industries in Larderello, Tuscany, shown in the top picture. The pent-up steam is first piped to giant turbines to produce electric power, then it is condensed and made to give up the boric acid and other chemicals it contains. Electric power from swift mountain rivers runs the streamlined train in the center picture. Italy is first among European countries in the development of hydroelectric energy. The bottom picture shows automobiles, made at the Fiat plant in Turin, being tested on a road built upon the roof of the huge factory.

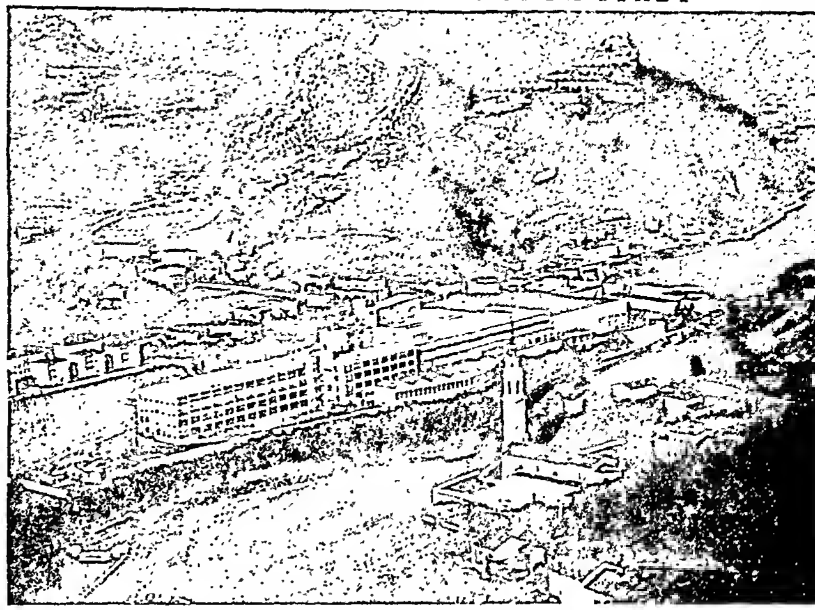
Hatred of foreign rule mounted and with it grew the *risorgimento*, or movement for political unity. Secret societies, such as the Carbonari (charcoal burners) plotted against the Austrians. Their name arose from their use of charcoal burners' huts in the mountains for their meeting places. Revolts in 1821 and 1831 were crushed by Austrian troops.

Then the idealistic republican Giuseppe Mazzini organized his revolutionary society, "Young Italy" (*see* Mazzini, Giuseppe). He called upon Charles Albert, king of Sardinia-Piedmont and a member of the ancient House of Savoy, to head a movement to liberate Italy. By early 1848 revolts had broken out in many regions and constitutions had been granted to Naples, Piedmont, and Tuscany. While Charles Albert battled unsuccessfully against the Austrians at Custozza and Novara, Mazzini drove out the pope and

set up a short-lived republic in Rome. The French came to the pope's aid and conquered Rome, while Austria quelled the revolt in the north. Charles Albert abdicated in favor of his son Victor Emmanuel II (*see* Victor Emmanuel II).

Under the able leadership of that shrewd diplomat Count Cavour, the great minister of Victor Emmanuel, Sardinia-Piedmont grew strong in resources and in alliances (*see* Cavour). Cavour had learned that, genuine as was Italian patriotic fervor, Italy would never be unified without help from abroad. Therefore he cleverly won the alliance of Napoleon III of France, and in the spring of 1859 Austria was goaded into declaring war. France and Sardinia-Piedmont defeated the Austrians at Magenta and Solferino and so won Lombardy for United Italy. Napoleon, however, hurriedly arranged matters with the Austrians, allowing them to retain Venetia. Cavour and Victor Emmanuel were clever enough to veil their disappointment and wait. At once the small states which checkered north-central Italy—Tuscany, Modena, and Parma—cast out their princes and joined the victor from the north. Napoleon III consented to the arrangement in return for the cession to France of Savoy and Nice.

A TEXTILE PLANT IN NORTH ITALY



This modern woolen mill at Valdagno, northwest of Vicenza, lies in a valley where the foothills of the Alps fringe the Po River basin. Industrial development in North Italy is based on dependable hydroelectric power from snow-fed Alpine rivers.

Garibaldi Marches Victoriously

The second step toward a united Italy came the next year when the famous soldier of fortune Giuseppe Garibaldi gathered about him his thousand red-shirted volunteers, stormed the island of Sicily, and then the rest of the kingdom of Naples on the mainland. The people everywhere hailed him as a liberator and drove out the hated Bourbon king (*see* Garibaldi). There remained only the Papal States and Venetia to be joined to the new-made Italian nation, when (in February 1861) Victor Emmanuel of Sardinia was proclaimed king of Italy. Venetia was gained in 1866, after Austria was defeated by Prussia in alliance with Italy. The Papal States alone were now outside the Italian kingdom, and the lack of that central and dividing strip of territory was a very real handicap.

"MARCH ON ROME" BRINGS FASCISM TO ITALY

Asked by the king to be premier, Mussolini (center) leads his Blackshirts into Rome, Oct. 30, 1922. The white-bearded man at the left is General De Bono, military chief in Ethiopia in 1935. The second man beyond Mussolini is *Italo Balbo*.

French troops still guarded the pope's sovereignty, but Victor Emmanuel was too intelligent a pupil of Cavour (who had died in 1861) to attack the French and thus perhaps undo all that had been accomplished.

Then in 1870 the Franco-Prussian War forced France to withdraw its soldiers from Rome. Immediately the Italian forces marched in. Pope Pius IX excommunicated the invaders and withdrew into the Vatican. There he and his successors remained "voluntary prisoners" until the Concordat of 1929 between Italy and the Holy See recognized the temporal power of the pope as sovereign ruler over Vatican City and a small adjacent territory, with a total area of 109 acres.

The Birth of Modern Italy

Giant tasks lay before the new Italy. Though staggering under a load of debt and heavy taxation, its

leaders built up an army and navy, and developed railroads, ports, schools, and a merchant marine. Manufacturing industries sprang up, bringing with them labor troubles and class struggles. In 1900 King Humbert, son of the first king, Victor Emmanuel II, was assassinated by an anarchist. His son, Victor Emmanuel III, succeeded to the throne. Meanwhile Italian statesmen were attempting to gain territory in Africa for colonial expansion. On the east coast they obtained two colonies of doubtful value, Eritrea and Italian Somaliland, and on the north coast they won Tripoli after a war with Turkey (1911–12).

"THE LIBERATOR OF ITALY"

Here is Italy's dauntless 19th century hero, Garibaldi. Twice exiled, he returned in 1859 to free Italy from foreign rule and unite it as a nation.

Italy's share as one of the Allies in the first World War, which it entered in 1915, won it regions that were formerly under Austrian rule. They included "unredeemed Italy" of the Trentino in the north, and the peninsula of Istria at the head of the Adriatic.

Rise of Mussolini and Fascism

Depression after the war brought strikes and riots, fomented by anarchists, socialists, and communists. The government of Victor Emmanuel III seemed powerless. Bands of former service men roamed the country—angry, embittered, dangerous—eager to strike a blow against the evils which faced Italy, but they were unorganized and lawless. In these bands a new Italian "strong man," Benito Mussolini, saw his opportunity (*see* Mussolini). With his gift of eloquence he soon organized them into enthusiastic groups in each community, armed them, and set them to preserving order. They formed the nucleus of his black-shirted Fascist party, whose emblem was the *fasces*, or rods, which had symbolized the authority of the Roman lictors.

The party grew rapidly because Mussolini promised benefits to everyone. The poor hoped for reforms which would end unemployment, raise wages, and lower prices. The rich pictured Fascism as a bulwark against the communism they feared. By Oct. 28, 1922, the Blackshirts, meeting in Naples, were strong enough to threaten to march on Rome and to seize the government. The King, fearing civil war, refused to proclaim martial law. The prime minister resigned and Mussolini was asked to form a government.

Within a few years Mussolini had reorganized the government so that the people had no voice in it. He was *Il Duce*, (The Leader), and all power rested in him. The King was retained as a figurehead because he was revered by the people and had the support of many wealthy and important families. Mussolini first abolished all parties except the Fascists and took from the Chamber of Deputies the power to consider any laws except those proposed by him. Then in 1938 he replaced it by a Chamber of Fasces and Corporations, composed of all the members of his Council of Corporations and of the National Council of the Fascist party. No semblance of popular election remained. Mussolini, acting as minister of the interior, named the prefects of the provinces and the mayors of the cities.

All opposition was crushed. Suspected critics of the régime were sentenced to prison by special courts or were terrorized, tortured, or murdered by Blackshirt thugs. News was censored and public meetings could not be held without the government's permission.

FOUNDER OF FASCIST ITALY

Pride filled Mussolini as he reviewed his Fascists. Like Garibaldi, he had created a new Italy. But his rule was dictatorial, and he was ousted in 1943.

The new Fascist state was based on the doctrine that the welfare of the state is all-important, and that the individual exists only for the state, owes everything to it, and has no right to protection against it (*see* Fascism). The subject's duty is to obey the government which is administered by a limited number of qualified leaders.

How Fascism Governed

The Fascist economic system was called the "corporative state." Employers and workers in every industry were organized into regional syndicates.

These syndicates were linked together into national corporations headed by executives who had the power to settle disputes. No strikes or lockouts were permitted. The Council of Corporations was composed of representatives of these national corporations and certain government officials. Theoretically the syndicates acted by the free vote of their members, but actually all were party men bound by oath of obedience to the leader.

By means of incessant propaganda the party sought to whip up the people's enthusiasm and loyalty. Mussolini's frequent speeches were followed by organized demonstrations. Military reviews and athletic exhibitions were staged to show the strength of the nation and its people. Children were taught the ideals of Fascism in the schools and in organizations like the *Balilla* for boys. As they grew older the boys were induced to become *Avanguardisti* (advance guards) in preparation for full membership in the Fascist party. After Italy's defeat in the second World War, the Allies undertook to remove the Fascist doctrines from the minds of Italian children by expurgating the party's dogma from old textbooks and writing new textbooks for use in Italian schools.

Mussolini believed a growing population to be a sign of strength, so he stopped the migration of Italians to foreign countries and gave prizes to large families in an effort to raise the birth rate. To feed the growing population in a poor country, he promoted agriculture through irrigation and drainage. He broke up many vast feudal estates and turned them into small farms for peasants. He encouraged the expansion of industry—especially heavy industry to supply his war machine.

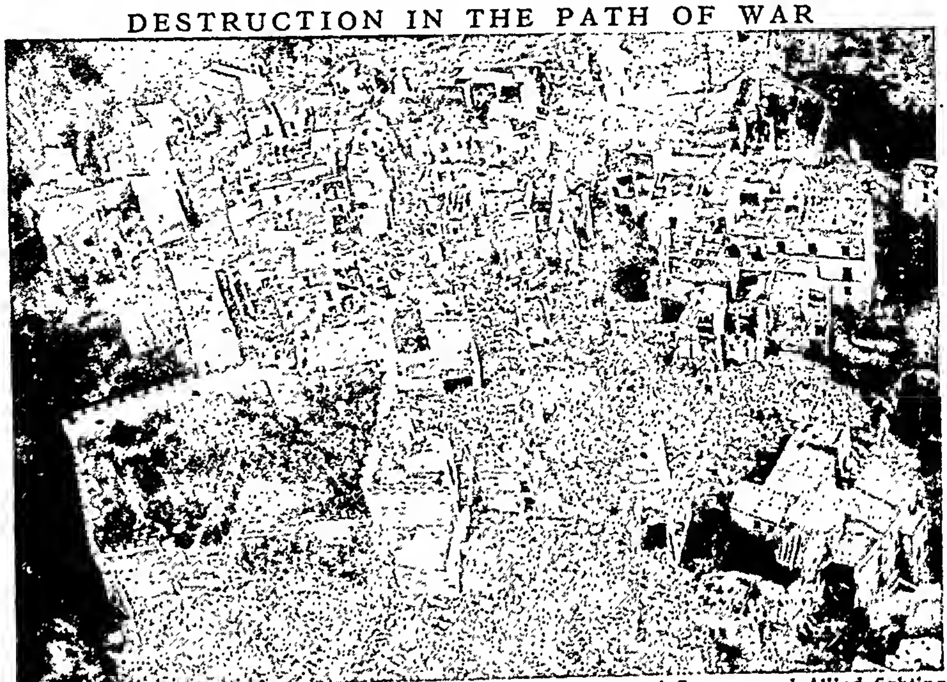
Seizure of Ethiopia and Formation of Axis

He longed to create a new Roman empire and to bring back Italy's lost glory. To this end he trained a large army and built up the Italian navy. In 1935 he attacked the weak, backward, and poorly defended African country of Ethiopia and conquered it the next year (*see* Ethiopia).

In October 1936 Italy began its partnership with Germany. At Mussolini's invitation, the two fascist nations formed a "Rome-Berlin Axis," to oppose the power of France and England. They helped Franco to victory in the Spanish Civil War. Axis pressure on England and France gave Czechoslovakia to Germany in 1938. And in April 1939 Italy invaded Albania, making it a protectorate. Italy and Germany then became formal military allies. (*See also* Albania; Spain.)

But when Germany's program of aggression plunged it into war with France and England on Sept. 3, 1939, Italy at first adopted the position of a "nonbelligerent." Not until French power had been destroyed did Mussolini join Germany in the war. Then on June 10, 1940, Italian forces attacked southeastern France in a "stab-in-the-back" invasion.

DESTRUCTION IN THE PATH OF WAR



This typical hillside village in southern Italy stood in the path of German and Allied fighting during the second World War. The aerial view shows the ruin wrought by the bombs and shells. Not a house escaped damage. Note the remains of the walled estate at the left.

Defeat in Second World War

But Italy lacked the military power, resources, and spirit for fighting a large-scale war. Within six months, Italian armies met defeat in Greece and North Africa. Italy then humbly accepted the armed aid of Germany. This military dependence soon grew into economic dependence, and Italy was forced to let Germany control its home affairs. Mussolini became a German puppet, and hard-pressed Italians fought only half-heartedly. After the Allies won all Italian territory in North Africa and invaded Sicily in July 1943, public unrest forced Mussolini to resign. He was arrested and held under guard. The constitutional monarchy was restored under the premiership of Marshal Pietro Badoglio.

Italy was already on the edge of collapse when the Allies invaded from Sicily, Sept. 3, 1943. After a token resistance, Italy surrendered unconditionally that same day. On October 13 it declared war on Germany. Meanwhile, Mussolini had been freed by German paratroops and had fled into German-held north Italy. There he established a "Republican Fascist State." In the next two years of war, the Allies slowly drove the Germans northward out of Italy. The entire length of the mountainous country became a bitter battleground (*see* World War, Second). Enemy

forces surrendered in northern Italy, April 29, 1945. Mussolini was captured by the partisans and shot.

Italy Impoverished by War

The end of the war found Italy with a large part of its industry and agriculture shattered. During the Nazi occupation, the Germans had commandeered supplies, almost stripping Italy. Bombing raids and the destructive tide of continuous battle ruined Italian factories, roads, docks, and entire villages. As the Germans retreated, they had wrecked remaining industries and transportation. Italy was in chaos. People were cold, hungry, and jobless.

The Allies contributed substantial quantities of food, clothing, and other supplies. UNRRA gave more aid to Italy than to any other country. But reconstruction lagged because of political turmoil and delay in drawing up a peace treaty.

Struggling Italy Becomes a Republic

With the coming of the Allied armies, many political parties sprang up, representing political views from the extreme left to the far right. The more liberal parties demanded an end of the monarchy. Backed by the Allies, however, Victor Emmanuel retained his sovereignty until the liberation of Rome in 1944. Then he delegated his power to his son Humbert. The unpopular Badoglio was forced to resign.

The local elections of March 10, 1945, represented the first free balloting in Italy in a quarter of a century. The vote was split among liberal Catholic, Socialist, and Communist parties. By 1946, Italy had had a number of cabinets. The strongest was headed by Premier Alcide de Gasperi, a Christian Democrat.

King Victor Emmanuel abdicated May 9, 1946, after a reign of 46 years, in favor of Humbert. On June 2 the Italians voted on the proposal to become a republic. In a close vote favoring the republic, monarchists charged irregularities. Riots broke out, but Humbert abdicated and went into exile.

The new régime was chaotic. Crisis followed crisis. The political turmoil reflected the unstable economic conditions and the rivalry for national control. Political power was split among Communists, Socialists, moderates, and a powerful remnant of Fascists.

Peace Treaty Strips Italy of Empire

Not until Feb. 10, 1947, was the peace treaty ready for Italy's signature. The treaty stripped Italy of its African empire of Libya, Italian Somaliland, and Eritrea. The pact also ceded the Dodecanese Islands to Greece, internationalized Trieste, made minor boundary changes with France, and gave some 3,000 square miles to Yugoslavia, including most of the Istrian Peninsula. Italy had to pay $360,000,000 in reparations. It was also forced to restore independence to Ethiopia and Albania. But south Tyrol, which had been given to Austria after the first World War, remained with Italy. The Italians felt that the treaty was harsh, since in 1943 the Allies had granted them the status of "co-belligerent."

New Constitution Bans Fascism

Italy's first constitution in 99 years became effective Jan. 1, 1948. It set up a republican democracy with a popularly elected National Assembly, made up of a Chamber of Deputies and a Senate, and a Constitutional Court. A president, elected by the National Assembly for a seven-year term, was given nominal power. The Fascist party and the House of Savoy were outlawed. Freedom of religion was guaranteed, but Catholicism remained the state religion.

The new republic faced grave problems. The war had sharpened Italy's old dilemma of supporting a large population on insufficient land and scanty resources. Millions were unemployed and near starvation. The government struggled with inflation and a huge national debt; strikes and riots were frequent. Emergency aid from the United States staved off collapse, but Italy needed basic land and social reforms.

Popular Vote Defeats Communism

In 1948 some 90 political parties entered the general elections, but the chief issue was between Communists and moderates. That issue became international when the United States threw its influence against the Communists. It warned Italy it would withdraw economic aid if Italians elected a Communist government. The Catholic church also opposed Communists. The moderate Christian Democrats, chiefly Catholic, won the election. Extreme rightists, representing the old Fascists, lost heavily. Communists, despite losses, held considerable strength. But the election seemed to demonstrate that most Italians preferred democratic government to authoritarian rule.

Italy's economic crisis continued, however. The expense of Mussolini's African colonial empire and the cost of war had virtually bankrupted Italy. An allotment of $585,500,000 by the European Recovery Plan relieved widespread suffering. But Italy's industrial production gained only little. The government checked inflation, but Italy still did not have the money to buy raw materials for large-scale production. Political instability discouraged investors. Italian unemployment was the worst in Europe.

Strikes and riots incited by Communists harassed the nation, but the conservative government survived. In 1949 it promised reform of the almost medieval land system. Large estates were to be cut up among landless peasants, but few such divisions were made.

Troubled Italy, however, regained a place in foreign affairs. It joined the North Atlantic pact in 1949. In protest, the Communists pledged aid to the Russian army if it "pursued an aggressor" in Italy.

Italy Loses Its Colonies

Italy also asked for the return of its colonies; but in 1949 the United Nations disposed of them. It made Italy trustee of Somaliland but promised it independence in ten years. An international commission guided Libya until 1951, when it became independent. Eritrea stayed under British administration until 1952, when it became federated with Ethiopia.

Loss of its colonies increased Italy's severe problem of overpopulation. Only about twice the size of Florida, Italy has about 20 times as many people. The average density of population in Italy is about 404 persons to the square mile, compared with about 60

to the square mile in the United States. Before World War II Italy had made some progress in encouraging migration to its colonies, especially Libya and Eritrea, where the Italian government furnished irrigation, homes, and farm equipment (*see* Libya).

Lack of migration facilities added to Italy's critical unemployment. The country has few natural resources for industry, and much of the farm land has low fertility. Even where a few estates have been broken up and distributed among small farmers, production is low. Old-fashioned farming customs and lack of fertilizers kept crops at subsistence level.

The cities were burdened with inadequate housing. Few nations have such widespread, wretched tenements as hard-pressed Italy.

Unemployment and Poverty Invite Communism

In 1954 the United States was still giving financial aid to Italy; but the nation's basically strained economy was little improved. The conservative Christian Democrat party, which supported the foreign policy of the United States, lost considerable ground in 1954. Communists, Socialists, and Monarchists all gained strength. The Italian Communists became the strongest Communist organization in Western Europe, with about one out of every three Italians being an active Communist or sympathizer. The Communists led riots in Sicily and in northern industrial cities, protesting unemployment.

Communist and Socialist opposition delayed Italy's signing of the European Defense Community pact. Italy's command of the Mediterranean Sea made it important to a unified defense of Western Europe.

Demands Return of Trieste

Italians of all parties continued to demand that the internationalized port of Trieste be returned to Italy. Yugoslavia, however, insisted that it be given Trieste, which it had seized in World War II. Italians and Yugoslavs clashed in the disputed city.

Meanwhile American and British troops occupied the city and some of the surrounding territory, while Yugoslav forces occupied some of the environs. The United States and Britain worked to make a compromise between the claims of Italy and Yugoslavia.

The two occupying powers proposed that the city of Trieste be returned to Italy and that the environs be held by Yugoslavia. Both Yugoslavia and landlocked Austria were to be given access to the port facilities of Trieste. The proposed compromise, however, did not wholly satisfy either Italy or Yugoslavia. (*See also* Trieste.)

A Journey to Italy's Great Art Treasures

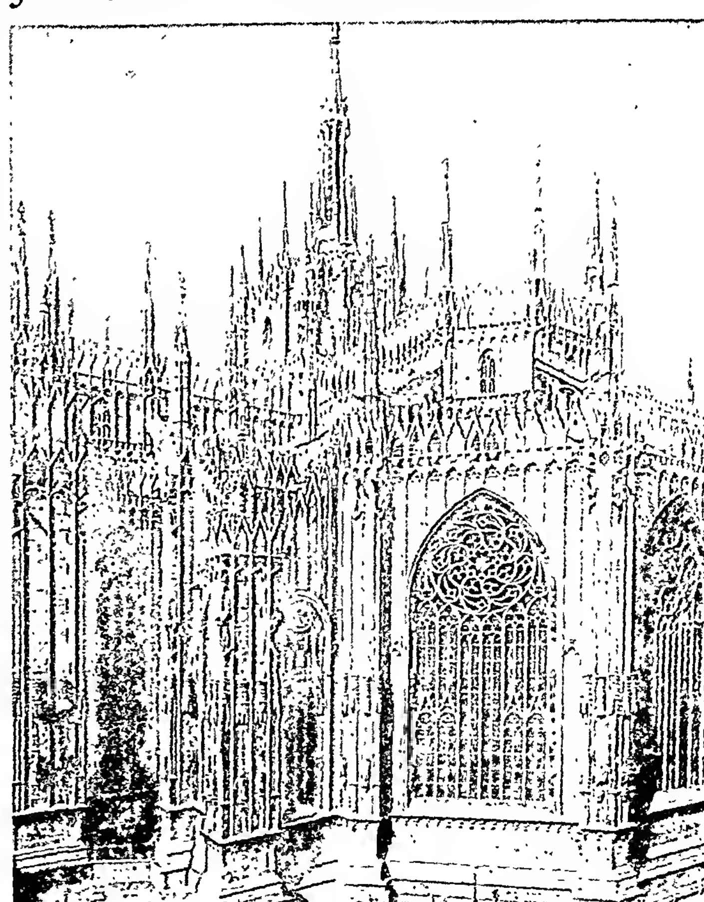
ON THE rugged, beautiful Italian peninsula lie more wonderful places, more mighty works of the hand of man, and more deathless memories of the human race than can be found in any other land beneath the sky.

Rome has in itself such a wealth of treasures from the glorious past that it surpasses all comparison. The traveler to Italy will want to make a separate occasion of his visit to the Eternal City (*see* Rome). Let us here sketch out a trip to some of the other famous places in this romantic country.

If we enter Italy from France, the starting point of our tour is likely to be Turin. In this city, situated on the Po River in northeastern Italy, we see beautiful palaces and art galleries. We stand for a fleeting moment on the city's heights and admire one of the most superb views in Italy. All around are the Alps, nature's mighty contribution to this treasure land. Then we take a train that meanders around and over mountains, past medieval towns and ruined castles, through ravines and over rivers, in and out of 20 tunnels, before we come to Genoa. We glimpse its great harbor where a boy called Columbus used to watch the ships go out, already dreaming of what wonders might lie beyond the western sea. The houses of Genoa are a striking sight, piled up like boxes between the high hills and the sea.

The Riviera and Little Pisa

We hurry past on our train and enter the Italian Riviera—a paradise on earth. Moun-



Milan's white marble cathedral is one of the most superb works of Gothic art in all Europe. On each pinnacle stands a statue. At the tip of the tower, 356 feet above the ground, is a golden Madonna.

tain villages, olive groves, green cypress trees, the yellow broom, and the orange trees with their golden balls—these and the blue sea all the way make up a matchless ride. Seven hours from Turin is a delightful little place, clean and white and beautiful. This is Pisa. In the days before the sea left Pisa, this little state kept the infidel out of Europe. The Italian city-states had great power, and Pisa lost its power only by the treachery of an admiral. However, it had a proud story before this sound of doom fell on its ears, and it put up a famous group of buildings as a thanksgiving.

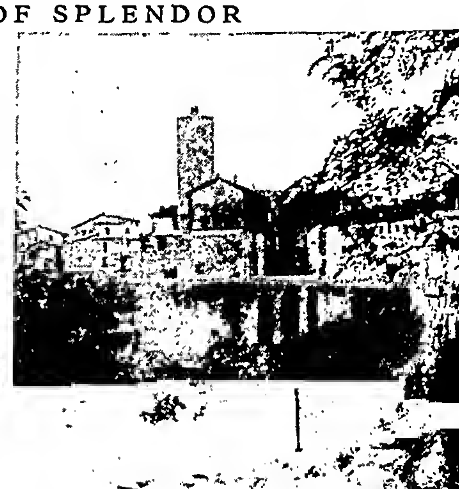
All the world has heard of its Leaning Tower, which served Galileo, who used to walk about these streets, for one of his great experiments. (For picture of Leaning Tower, *see* Pisa.) It is said that this great campanile was only one of ten thousand towers built in the grand days of Pisa. There is one more thing that lingers in the memory of those who have visited Pisa. It is the Campo Santo, the little graveyard where for centuries the great men of the city were laid to rest. Before it was damaged by Allied air raids and artillery fire during World War II, many travelers admired this cemetery more than they did the Milan Cathedral in northern Italy.

Milan's Cathedral of Marble Grandeur

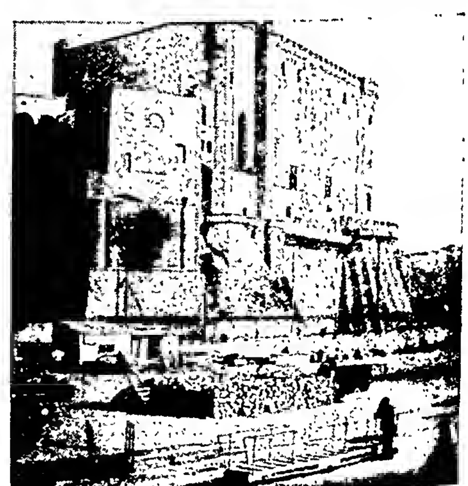
This great place—the noblest work of art in the industrial area of Lombardy that Milan dominates—is made of white marble. Other great Gothic cathedrals are of soft gray stone, wind-bitten and crumbling, darkly meditative, mysteriously hiding age-worn statues of saints and angels in their vague shadows. The Duomo of Milan, on the other hand, is icy hard, dazzling clear in detail. Its pure white marble hides nothing, seems to hold no shadows. From its roof a forest of pinnacles in sharp white stone rises up. There are more than 4,000 of these pinnacles and on each one of them stands a carved statue of a hero or a martyr. These heroes and martyrs raise a victorious cross, they lift prophetic arms or prayerful hands, which reach out sharp and perfect as though newly chiseled from the stone.

ITALY PRESERVES DAYS OF SPLENDOR

A fountain thrusts up against dark cypress trees to cool the elaborate garden of the Renaissance Villa d'Este at Tivoli.



This medieval village of Nemi stands in the Alban hills. A watchtower rises in the background.



The 13th-century castle of the kings of Naples shows the scars left by artillery shells and bombs in World War II battles.

The rich darkness of the cathedral's interior offers relief from the glare of the bright Italian sun pouring on the white marble. Here anew you realize the enormous size of the cathedral, third largest in Europe. It is 486 feet from one end to the other—a long vista through another forest of stone, great thick soaring columns which support the roof. Its form of a Latin cross spreads 287 feet wide. When you look up at the huge stained glass windows—which the guide boastfully tells you are "the largest in the world" —you are a bit disappointed by the realization that they were not made until 1844.

Built to Fulfill a Vow

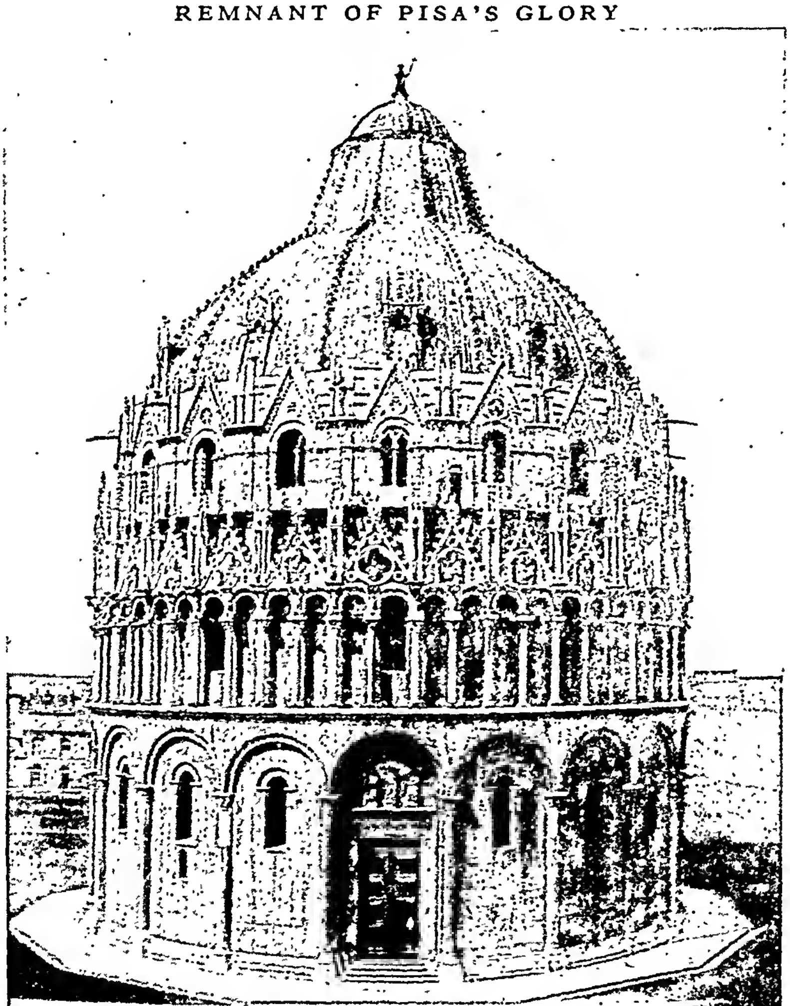
The great cathedral was founded in 1386 by the vow and the purpose of Giovanni Galeazzo Visconti, ruler of Milan. The Visconti family bequeathed the quarries of Ticine to this church, and a canal was built just to carry blocks of white marble for the slowly rising structure. In the depths of the cathedral is one of the most gorgeous tombs in all the world containing the bones of Saint Carlo, archbishop of Milan. The tomb is a large eight-sided room of solid silver, and on each of the eight panels is a bas-relief showing a scene from the life of the saint. From the ceiling sparkles a cross of emeralds and diamonds, gift of the Empress Maria Teresa. But we fix our gaze upon the withered body of Saint Carlo as it lies in red, pontifical robes in a great casket of rock crystal and silver, gift of the evil King Philip IV of Spain. Its hand clutches a pastoral staff of gold and gems, and above the head hangs an ethereal, gold, bejeweled crown, probably the work of the famous Benvenuto Cellini.

Florence, City of Beauty

From Milan we travel to Florence. He who has been to Florence will never forget it while his memory lasts. It is like a poem that would not come in words and was written in stone, and its poets are many. Its squares are little worlds of art. Its shops are packed with treasures. The doors of its churches hold the traveler fixed in front of them. Its towers rise to the sky like things not made with hands. Its streets are guarded by silent sentinels that have stood there through the ages. Its great houses stand as if they were built forever. Its galleries are hung with pictures deathless in Time.

In the heart of Florence rises Giotto's tower, straight from the street where the children play, and it climbs up toward the clouds for 276 feet. (For picture of the tower, *see* Giotto.) Beside it stands the Duomo, the great cathedral of Santa Maria del Fiore. Its immense bronze doors, with Bible mosaics above them, are almost perfect things. Across the street from the cathedral, behind us as we look up at the tower, is the baptistery, the quaint structure built before England had won its Magna Carta—where for more than a thousand years children of Florence have come to be baptized. The cathedral is the more imposing edifice, but nothing about it can surpass the baptistery's famous bronze doors, especially the two modeled and cast by Lorenzo Ghiberti. (For picture, *see* Renaissance.)

REMNANT OF PISA'S GLORY



The Baptistery at Pisa is a circular building 100 feet in diameter. On the cone-shaped dome is a statue of St. Raniero. The Baptistery was begun in the 12th century, when Pisa was Tuscany's foremost city, and completed in the 13th century.

Florence has magnificent soaring towers. The stern, slender, rugged tower of the Palazzo Vecchio looks almost as if it would fall, though it is like the rock of ages. The great white campanile tower by the cathedral surely will endure, even though in its beauty and daintiness it is like the lily of the valley. We look up at the tower of the Palazzo Vecchio from the great square where Savonarola was burned to death.

On our right is the loveliest of all those art galleries in the open air which are one of the beauties of Florence. It is the Loggia dei Lanzi, an open hall

with a vaulted roof. Here is the splendid bronze statue of Perseus which Benvenuto Cellini made some four centuries ago. It was impossible, so his rivals said, to cast in bronze a statue so designed; and the triumphant artist nearly killed himself in his resolve to melt the metal at any cost and force it to flow into the remotest part of the mold.

From here we pass between the two sides of the great Uffizi Palace. At every step we pause to look on the statues which line this beautiful way—two rows of figures standing in the niches of the walls, of the great makers and dreamers of Florence. Beyond them we descend stairs into a passage that leads into the famous Lung' Arno, a street by the river Arno. Our stroll carries us over an old, old bridge—the Ponte Vecchio—to the art galleries in the Pitti Palace on the other side of the river. Behind the Pitti Palace is the delightful Boboli Garden, adorned with many beautiful vases and statues.

In the great squares and streets of Florence we walk about enthralled. One morning, when the sun is high in the heavens, we climb up the hills across the Arno and walk about the fortifications built by Michelangelo to keep the Medici tyrants out. Round and round we climb until, halfway up the hillside, we reach the square from which a bronze copy of Michelangelo's 'David' looks down—a famous figure, immortal in the history of art, standing in splendor on a hill above the ancient town. The marble original of this beautiful young warrior stands in the Domed Room of the Academy of Fine Arts on the other side of the river Arno.

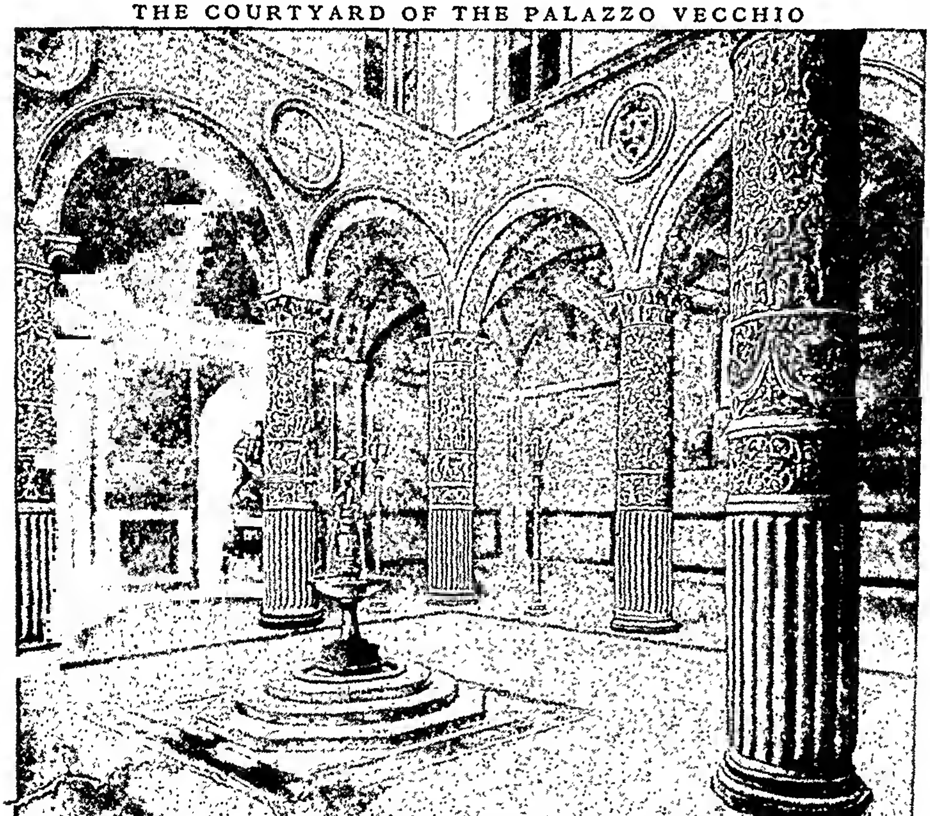
Enchanted Islands of Venice

Florence holds the traveler like a magnet, but still there lies before him that city like a dream up in the north—Venice. Venice is a city—for centuries a widespread empire—that has grown up on the dust of the Alps, brought down by the rivers and cast into the sea. Into these islands formed in the lagoons of the Adriatic men drove huge piles, upon which they built magnificent palaces and churches.

The city's commerce covered the Mediterranean and reached to the heart of Asia on the east and to the farthest limits of Europe on the west. Here came painters and sculptors and poets and preachers and builders and workers in mosaic, such as never before came together in the history of the world. Here, even long after the political and commercial ruin of Venice, came Byron and Browning, and Ruskin and Wagner. Here lived Tintoretto, one of the "five supreme painters"; across the little canal is the church where he lies. Here lived Paul Veronese, painting immortal poems of beauty on the walls of Venice. The central glory of this city of art is St. Mark's Cathedral. Here, tradition says, the apostle Mark is buried. We enter through one of the six great doors, and we see that St. Mark's is laid out in the form of a cross. It is not so big as the Milan Cathedral, which holds 40,000 people; but its arches and altars and many domes take our breath away. The upper half of the interior is covered with beautifully colored mosaic. Half-inch by half-inch these almost countless scenes in the life of Christ were built up. These wonderful mosaics cover an area of nearly 50,000 square feet, and some of them are nearly a thousand years old.

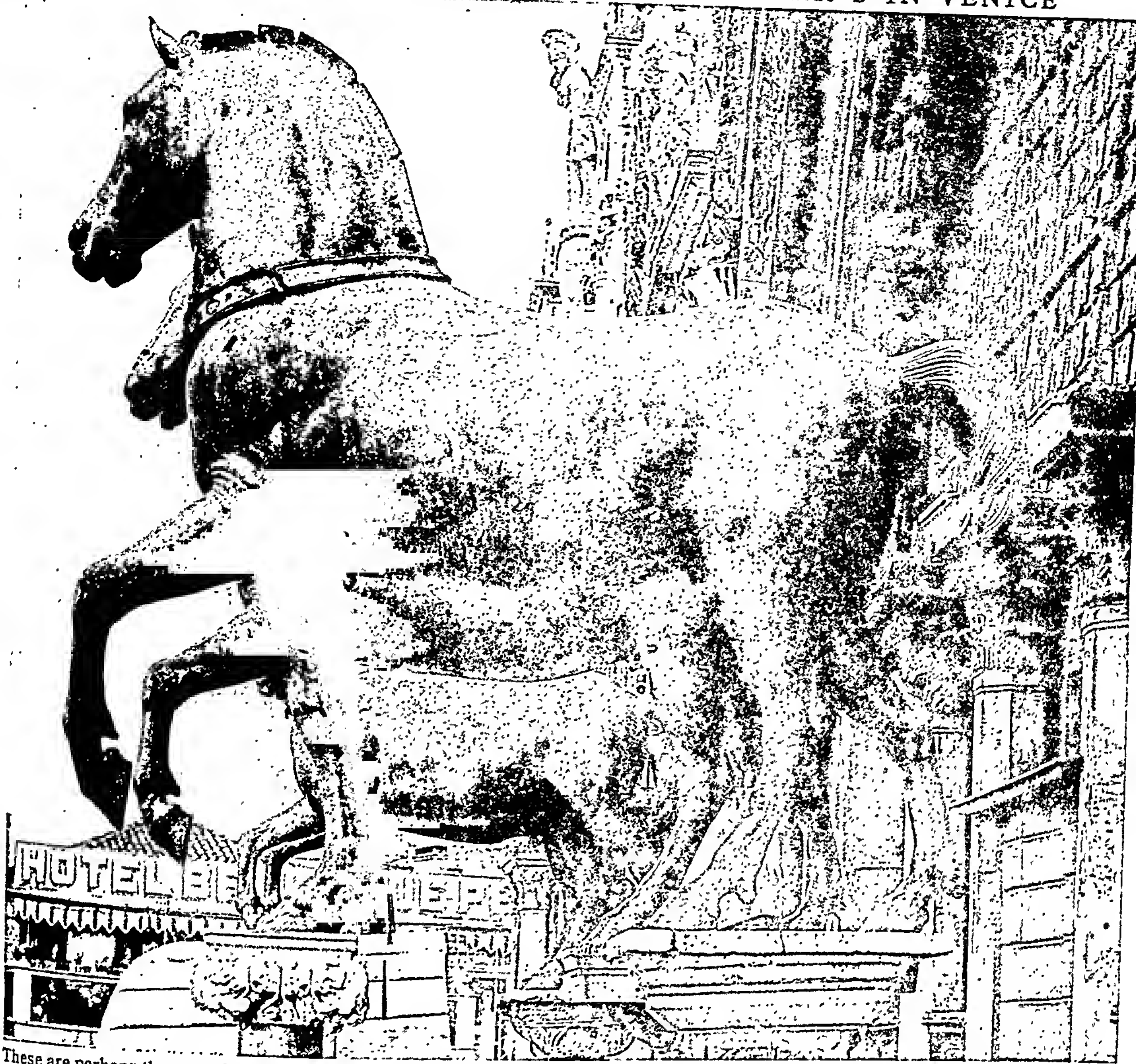
Unequaled on the earth is Italy, land of wonders old and new. The spirit of many centuries lies beneath the surface of modern life, for everywhere are there evidences of the age when Italy was the center of the world.

THE COURTYARD OF THE PALAZZO VECCHIO



The Palazzo Vecchio or "Old Palace" was built early in the 14th century to house the government of Florence. In modern times it became the City Hall. In sharp contrast with its severe exterior, this courtyard is elaborately decorated in the later Renaissance style. Of special interest is the fountain. The basin is porphyry and the figure of a boy with a fish was made by the sculptor Verrocchio. Above the colonnade are carved armorial bearings. The coat of arms at the right is that of the Medici family, who once lived in this superb palace.

ANCIENT BRONZE HORSES ADORN ST. MARK'S IN VENICE



These are perhaps the most famous horses in the world. Four of them, in bronze, stand over the central portals of St. Mark's looking out on the square. They were made at Corinth nearly 20 centuries ago. Nero took them to Rome, Constantine to Constantinople; thence they were moved to Venice during the Crusades. Napoleon carried them to Paris 600 years later. After Napoleon's fall, the horses were returned to St. Mark's. During World Wars I and II they were taken down again.

REFERENCE-OUTLINE FOR STUDY OF ITALY

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BIBLIOGRAPHY FOR ITALY

Books for Younger Readers

Angelo, Valenti. The Marble Fountain (Viking, 1951).
Baker, N. B. Garibaldi (Vanguard, 1944).
Botsford, F. H. Picture Tales from the Italian (Lippincott, 1929).
Coe, Douglas. Marconi (Messner, 1943).
Gallico, Paul. The Small Miracle (Doubleday, 1952).
Hall, Jennie. Buried Cities (Macmillan, 1922).
Jewett, Sophie. God's Troubadour (Crowell, 1940).
Kyle, A. D. Apprentice of Florence (Houghton, 1933).
Mills, Dorothy. Book of the Ancient Romans (Putnam, 1927).
Politi, Leo. Little Leo (Scribner, 1951).
Ripley, Elizabeth. Leonardo da Vinci (Oxford, 1952).
Snedeker, C. D. P. Forgotten Daughter (Doubleday, 1933).
Tinyanova, Helen. Stradivari, the Violin Maker (Knopf, 1938).
Weil, Ann. Red Sails to Capri (Viking, 1952).
Winwar, Frances. The Land of the Italian People (Lippincott. 1951).

Books for Advanced Students and Teachers

Albrecht-Carrié, René. Italy from Napoleon to Mussolini (Columbia Univ. Press, 1950).
Burton, Jean. Garibaldi, Knight of Liberty (Knopf, 1945).
Carnahan, Ann. Vatican (Farrar, Strauss, 1949).
Clark, S. A. All the Best in Italy (Dodd, 1953).
Davis, W. S. A Day in Old Rome (Allyn, 1925).
Foster, G. S. Augustus Caesar's World (Scribner, 1947).
Guareschi, Giovanni. Don Camillo and His Flock (Pellegrini, 1952).
Guareschi, Giovanni. Little World of Don Camillo (Grosset, 1951).
Hersey, John. A Bell for Adano (Modern Library, 1946).

Marriott, Sir John. Makers of Modern Italy (Oxford, 1931).
Moorehead, Alan. Villa Diana (Scribner, 1951).
Nash, Ernest and Prezzolini, Guiseppe. Rome (Regnery, 1950).
O'Faoláin, Sean. Summer in Italy (Devin-Adair, 1950).
Ogrizek, Doré. Italy (McGraw, 1950).
Olschki, Leonardo. Genius of Italy (Oxford, 1949).
Rothery, A. E. Rome Today (Dodd, 1950).
Salvatorelli, Luigi. Concise History of Italy (Oxford, 1940).
Sforza, Carlo. Contemporary Italy (Dutton, 1944).
Sforza, Carlo. Italy and the Italians (Dutton, 1949).
Sutton, Horace. Footloose in Italy (Rinehart, 1950).
Walter, Gerard. Caesar (Scribner, 1952).

IVAN, GRAND DUKES AND CZARS OF RUSSIA. Six Russian rulers have borne the name Ivan—the Russian form of John. The first three ruled before the country was united and were known as grand dukes of Muscovy (Moscow). Ivan IV was the first of Russia's czars.

IVAN III, the Great (born 1440, ruled 1462–1505) made Muscovy a powerful military state. By 1480 he was strong enough to refuse to pay the customary tribute to the Great Khan. This ended completely Moscow's long subjection to the Tatars, whose Golden Horde had overrun Russia in the 13th century.

After the fall of Constantinople to the Turks, Ivan married Sophia (Zoë), niece of the last Greek emperor of Byzantium (*see* Byzantine Empire). Because of this marriage, Ivan III and the rulers who followed him claimed to be successors of the Byzantine emperors. Sophia introduced the ceremonious etiquette of the Byzantine court into the Kremlin, and the imperial two-headed eagle of the Byzantine empire was added to the arms of Muscovy. (*See also* Moscow and Russia, section on history.)

IVAN IV, the Terrible (born 1530, ruled 1533–1584) had himself crowned czar in 1547. The word czar, or tsar (Latin, Caesar), was the Russian title for the Byzantine emperor. It remained the official title for Russia's rulers until Peter the Great substituted for it the title emperor, and it continued in popular use down to the Bolshevik revolution of 1917.

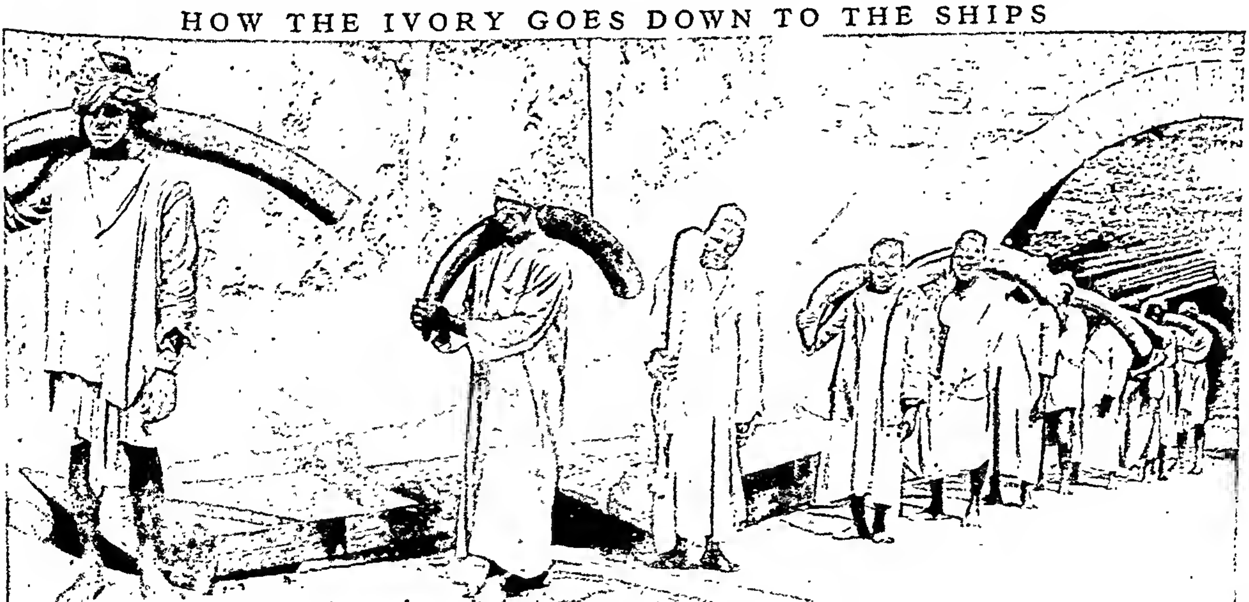
Ivan had grown up in a brutal environment. When he was 20 he did public penance for the sins of his youth and for years he ruled justly. In general he favored the middle class at the expense of the *boyars* (Russia's land-owning aristocracy) and the serfs. The economic "reforms" he introduced ruined entire boyar families, and Ivan took over their estates.

After about 1560, Ivan seems to have been insane. He imagined every man was against him, and he ordered wholesale executions of the boyars. Finally, in a fit of fury, he struck his beloved son Ivan and killed him. He suffered agonies of remorse for this act and in the last moments of his life, three years later, he put on a hood of an order of hermits and died as the monk Johan. (*See also* Russia, section on history.)

IVORY. As the greatest prize of the miner is gold or gems, so the greatest prize of the hunter is ivory. This useful and precious substance is the dentine which makes up the tusks of elephants and a few other animals. From ancient times ivory has symbolized adventure and danger as well as luxury, for hunters must penetrate the wildest jungles of Africa and Asia to get the best grades of elephant ivory.

In the ivory trade, elephant tusks are called teeth. This name properly belongs to them, for they are the elephant's upper incisors. (*See also* Elephant.) The tusks may grow to a length of 11 feet and may weigh 200 or 235 pounds apiece. However, such sizes are unusual; the average weight of tusks in an ivory shipment rarely exceeds 55 or 60 pounds. The bark, or exterior, of a tusk is often dark; the interior is white or cream-colored and of a beautiful grain.

HOW THE IVORY GOES DOWN TO THE SHIPS



By jungle trail, these tusks of ivory have come from elephant hunters' huts in East Africa to Mombasa, leading port of Kenya Colony. So many thousands of elephants are killed every year for their ivory that these giant beasts are fast being wiped out in Africa. Even so, most of the ivory comes from native stores, and less than a fifth from elephants newly slain. Not a particle of the precious ivory is wasted in manufacture. Scraps are saved for inlays, and the dust is used for polishing and in India ink.

The African elephant's tusks are much larger and the ivory of a better quality than that of the Asiatic elephant (*see* Elephant). Millions of these animals have died at the hands of ivory hunters. African elephants are protected from indiscriminate slaughter in most of their favorite haunts today, with the result that much of the ivory that reaches the market now comes from old stores long ago accumulated by tribes of the interior.

Because of its soft-toned, fine-grained texture and its elasticity, ivory is a specially good material for fine carving. It has been used for piano keys, combs, handles for knives and umbrellas, and similar objects. Synthetic plastics, however, have largely replaced it for utilitarian purposes.

Small quantities of ivory are also obtained from the hippopotamus, narwhal, walrus, and other animals whose teeth and tusks are prominent features. In addition vast stores of fossil ivory are preserved in more or less perfect condition in the frozen tundras of Siberia, Alaska, in Colombia, South America, and other regions. Much of this ivory is the tusks of the mammoth, the predecessor of the elephant.

The use of ivory can be traced to prehistoric times. The early cave dwellers executed figures of animals on tusks, bones, and horns. Examples of inlaid Egyptian ivory still exist, and in the British Museum there are many Assyrian ivory carvings made in Nineveh nearly 1,000 years before Christ. We read that King Solomon had "a great throne of ivory." In ancient Greece ivory was used for carvings, sculpture, and various objects of luxury. The sculptures in ivory of the Gothic art of the 13th and 14th centuries are distinguished for their beauty. Ivory mirror cases, caskets for jewelry or toilet purposes, and other articles were carved with scenes from real life or with illustrations of the romances, which set forth vividly the dress and customs of the times.

Vegetable ivory, a material resembling ivory, is obtained from a palm native to tropical South America. This tree grows 30 or 40 feet tall and has beautiful spreading leaves. White blossoms appear at the base of the leaves and develop into clusters of burlike fruit. Each bur contains 15 to 100 nuts, called corozo nuts or tagua nuts. The kernels of the nuts are manufactured into buttons. Naturally almost white, the material takes dye well and can be polished to a high, permanent gloss. The buttons are usually sold as ivory buttons. (*See also* Buttons.)

IVY. Several different kinds of climbing or creeping plants are known by the name of ivy. All are hardy shrubs or vines, growing in moderately cool, moist regions of the Northern Hemisphere. They climb by means of suckerlike disks which attach themselves to walls and trees; or by means of twining tendrils. Many are cultivated as ornamental plants to cover walls and as ground cover in shady places where grass will not thrive.

Contrary to common belief, ivy does not ordinarily injure its means of support. A fair growth of ivy on sound walls promotes dryness and warmth, reduces weathering, and adds beauty. However, an excessively heavy growth upon a tree may strangle it.

English ivy (*Hedera helix*) belongs to the ginseng family *Araliaceae*. It is an evergreen creeping or climbing shrub, native to Europe, Asia, and North Africa. It has been introduced into eastern North America where it grows wild in open woods and is cultivated as an ornamental plant. The leaves are single, unlike those of some other ivies which are compound—that is, divided into several leaflets. They turn a brilliant scarlet in the fall. The berries are black.

A closely related form is Irish ivy (*Hedera canariensis*), native to the Canary Islands and North Africa and introduced into California. The leaves are larger and a richer, deeper green.

Virginia creeper, also called woodbine and American ivy (*Parthenocissus quinquefolia*), and Japanese, or Boston, ivy (*Parthenocissus tricuspidata*) belong to the same family as the grapes, *Vitaceae*. The leaves of the Virginia creeper are divided into five leaflets (*see* Virginia Creeper). The basal leaves of Boston ivy are divided into three leaflets, but the leaves of the climbing stem are single, with three cusps, or points.

Poison ivy (*Toxicodendron radicans*) may be distinguished from Virginia creeper by its three leaflets instead of five. The stem of the center leaflet is longer than the stems of the leaflets on either side. This helps to distinguish it from Boston ivy. The berries in the fall are creamy, waxy white, whereas those of the other ivies are black or blue. (*See also* Poisonous Plants. For picture in color, *see* Flowers.)

Ground ivy (*Glecoma hederacea*) is a member of the mint family (*Labiatae*). It is a small creeping plant with blue-purple flowers. The small leaves are only about half an inch across. This plant does not climb. It grows in shady waste places from Canada to Oregon and as far south as Georgia. It blossoms from early March to June.

A GROUND COVER OF ENGLISH IVY

The English ivy is often used as a ground cover. It has dark green leaves that turn scarlet in the fall. The flowers are small and greenish, followed in the fall by black berries. This plant also climbs by means of tendrils.

J

JACKAL. Asia, Africa, and southeastern Europe are the home of the jackal. The animal looks like the dog and the wolf in many ways. But it has a pointed muzzle and bushy tail like the fox. The common jackal of southern Asia is the best known. It is grayish-yellow in color, darker above and lighter on the underside. It may be from two to two and one-half feet long from nose to tail. The tail is about eight inches long.

Jackals hide by day in burrows and caves. A female often has a special hole in the earth. Here she gives birth to her puppies, from three to five at a time. At night jackals come out to hunt, often in large packs. They howl and yelp in an unearthly way like the coyote. They annoy farmers by eating poultry, fruit, and vegetables, but they help to clean village streets by eating dead animals. They shadow wounded animals and haunt battlefields and burying grounds. Packs of jackals often attack sheep and antelopes. Jackals are easily tamed, and the domestic dog is probably descended in part from them.

The jackal resembles the wolf and the dog in its teeth, in the round pupils of its eyes, and in many of its habits. Like the fox it gives off an offensive odor from a gland at the base of the tail. The common jackal (*Canis aureus*) may be seen from Yugoslavia in Europe to India. (*See also* Dogs.)

The FRONTIERSMAN *Who Became* PRESIDENT

JACKSON, ANDREW (1767–1845). When Andrew Jackson came upon the stage of American political affairs as the seventh president of the United States, a new era began in the history of the country. The control of the government by the "Virginia dynasty" and the Adams family was at an end, and the rule of the frontier had begun.

As a specimen of the new type of American manhood which was now to dominate the country, no better person could be found than Andrew Jackson. The son of Scotch-Irish parents who had settled in the frontier wilderness of the Carolinas shortly before his birth, he displayed the characteristics of the Waxhaw region in which he was born and reared. He was uneducated, crude, and fond of fighting; but energetic, self-confident, honest, and straightforward. Ardently loved by his friends, he was just as cordially hated by his many enemies—a hatred which he abundantly returned.

ANDREW JACKSON

Jackson's lack of education was due, not only to the poor schools on the frontier, but also to his own indifference to books, and to his unwillingness to be taught. He never learned to speak or write correct English, and one of his enemies once said that "his letters, with their crudities in spelling and grammar, would make the better educated angels weep."

During his whole life Jackson could wield the sword more readily than the pen. He was always ready for a quarrel, a readiness which in later life involved him in numerous duels. When he was 13 years old he found a good cause for fighting, for South Carolina was overrun by the British, and young as he was he joined an expedition to drive them out.

At the close of the Revolutionary War, Jackson found himself alone in the world, for his two brothers had been killed and his mother had died as a result of the hardships she endured nursing American prisoners. After trying several occupations, Jackson studied law and learned enough to be admitted to the bar in 1787. For the position of prosecuting attorney in Nashville, which he accepted in 1789, he had precisely the characteristics needed. Courage was the chief requisite, for offenders often came to court supported by bands of their friends. Jackson possessed plenty of both moral and physical courage, and though impatient of restraint himself, he was quite as determined to make other men obey the law, a resolution which won for him the esteem of the law-abiding and the respect of evildoers.

These qualities soon gained him recognition as spokesman of the West. He was member of Congress at 29, United States Senator at 30, judge of the Supreme Court of Tennessee at 31, and major general of militia on a dangerous frontier at 35.

When Jackson entered Congress in 1796 the aristocratic governing class of the East looked with disgust upon this grave backwoodsman. One noted his uncouth dress and manner, his hair done up in a

queue with an eel skin; and Jefferson declared that his "violent passions choked his utterance" whenever he attempted to make a speech. Jackson evidently cared no more for the people he met at the national capital than they did for him, or perhaps he recognized his unfitness for a position among the dignified members of the Senate. At any rate he resigned in 1799, to return to Tennessee as a justice of the Supreme Court of the state.

Enter the Hero on Horseback

When Jackson next appeared in national politics he came as a military hero and the popular idol of the West. He had offered his services at the beginning of the War of 1812, but his two great victories in that conflict were irregular. The one on March 27, 1814, over the Creek Indians at Horseshoe Bend, Ala., was really a campaign of the states of Tennessee, Georgia, Mississippi, and Alabama, and not a part of the federal operations. His greater victory at New Orleans, on Jan. 8, 1815, was gained after the treaty of peace was signed, but before it was known in America. His victory over the Indians had important results, for it broke the power of the redmen in the Southwest, and gave America a chance to concentrate her forces for the conflict with England. The victory at New Orleans did not have any bearing on the results of the war, but it was regarded by the people of the country, especially of the West, as having removed the danger of foreign control of the Mississippi River. In some sections of the country "Jackson Day," January 8, is a Democratic festival.

JACKSON'S ADMINISTRATIONS
1829–1837

"Spoils" appointments to office (1829).
Webster-Hayne Debate (1830).
Garrison publishes 'The Liberator' (1831).
McCormick invents reaper (1831).
South Carolina threatens secession over tariff (1832).
Jackson's war on the Bank (1832–37).
Texas secedes from Mexico (1835).
War with Seminole Indians (1835–42).
Arkansas and Michigan admitted (1836, 1837).
Financial Panic of 1837.

Jackson always went straight for what he wanted. This characteristic sometimes involved him in difficulties, as it did in 1817. He had been ordered to the Florida frontier where the Indians were massacring the American settlers. Jackson, with many others, felt that the redmen were incited to these raids by the British and the Spanish. As a frontiersman he hated the Indians. Because of the ill-treatment he had received while a prisoner during the Revolutionary War, he hated the British; and as a Westerner he disliked the Spanish because they frequently closed the Mississippi River to American commerce. His hostility to these three peoples made the expedition to Florida an especially agreeable one to Jackson. Without waiting at the frontier for further orders, he crossed into Spanish territory, captured Saint Marks, and there hanged two British subjects. These high-handed proceedings naturally raised delicate diplomatic questions. Calhoun, then secretary of war, proposed that Jackson be censured for exceeding his orders. Nothing came of his suggestion except the lifelong hostility of Jackson to Calhoun.

However much his actions may have embarrassed the government at Washington, they only served to make Jackson more popular in the West. Nor was this popularity lessened by his arrogant conduct while governor of Florida, after that territory had been purchased in 1819 from Spain. Instead it increased until, in 1824, he became one of the five candidates for the presidency. Though he received more of the electoral votes than any of the other candidates, he did not have a majority and the choice therefore went to the House of Representatives. In that body Clay's followers, realizing that their leader could not be elected, gave their votes to John Quincy Adams, who in consequence was elected. When Adams appointed Clay as his secretary of state, Jackson was convinced that he had been cheated out of the presidency by a "corrupt bargain" between his two rivals. Many agreed with Jackson, although there was no ground for this charge; and the feeling that he had not been treated fairly, together with the dislike many felt for the cold uprightness of Adams, and their admiration for Jackson, gave him the election in 1828 as a Democrat by an electoral vote of 173 to 83 cast for Adams as a "National Republican" (Whig). It should not be forgotten, also, that Jackson's campaign was very skillfully managed by his friend and adviser, William B. Lewis. John C. Calhoun of South Carolina was reelected vice-president but soon resigned owing to strained relations with Jackson.

The Spokesman of the Common People

The common people felt that at last they had an executive who was one of them. Crowds swarmed into Washington on inauguration day. Half the men wore their trousers tucked into their bootlegs and not a few carried pistols openly in their belts. The contrast between "Jeffersonian democracy" and "Jacksonian democracy" was as marked as the difference between Jefferson's mansion at Monticello, and the backwoods log cabin in which Jackson spent his youth.

Jackson regarded himself as a spokesman for the common people, in whom he had absolute confidence. This belief he expressed in the phrase "Let the people rule," and in order to let them "rule" he removed from office in the first year of his administration about 2,000 office-holders to make room for his friends. This was an application of the hurtful "spoils system," with its cry, "To the victor belong the spoils," which flourished and corrupted American politics for more than half a century and which civil service laws have not yet altogether removed.

This same hatred for anything resembling class privilege led Jackson to attack the Bank of the

United States. He vetoed the bill granting the bank a new charter, and declared its control of the country's money was a menace to business and democratic government. The election of 1832 was fought on the issue of "Jackson or the Bank," and Jackson won by a large popular vote (219 electoral votes to 49 for Henry Clay). Martin Van Buren was chosen vice-president.

ANDREW JACKSON WINS THE BATTLE OF NEW ORLEANS

Here "Old Hickory," on a white charger, directs his motley band of frontiersmen, militia, and Baratarian pirates. Their deadly fire, over their hasty fortification of logs and cotton bales, sends the British regulars reeling. Peace had been made in the War of 1812 before this battle was fought.

Jackson took his re-election as a verdict against the bank from the supreme authority of the country—the people; and although the bank's charter still had three years to run he directed that the government funds should be taken from it and deposited in "pet" state banks. The "dying monster," as Jackson called the bank, fought savagely, but in the end it was defeated and was compelled to transform itself into a state bank of Pennsylvania.

The banks which had the use of the government funds began to issue paper money in enormous quantities, and the wildest speculation followed. Then suddenly Jackson, in 1836, issued his famous "specie circular" declaring that the government would accept only gold or silver in payment for public lands. At about the same time he called upon these banks to give up the money which had been deposited with them, so that he might lend it to the states. The result was a disastrous panic, but since it came upon the country just after Jackson left office, the blame for it fell upon his successor.

He Increased Powers of President

Although Jackson was such an opponent of all forms of control by the "few," he was one of the most despotic presidents the country has ever had. He usually ignored his Cabinet officers, and sought advice from a little group of friends which became known as the "Kitchen Cabinet." He enlarged the power of the president in his relations with Congress by freely vetoing bills. His six predecessors taken together had vetoed nine bills. Jackson vetoed 12, besides using the "pocket veto" freely (*see* Veto).

He also increased the influence of the executive by the firm position he took in a conflict between South Carolina and the government of the United States. South Carolina objected to the tariff law of 1832, and issued an ordinance declaring that it should not be obeyed in that state. Jackson responded with a proclamation warning the South Carolinians of his determination to enforce the law—by the bayonet if necessary. He had earlier announced his unalterable opposition to what is called "nullification" and "secession" by a famous toast which he gave at a banquet attended by South Carolinians: "Our Federal Union—it must be preserved." Jackson did, however, recommend to Congress that the tariff be revised, and the bill for this was passed on the same day that a "force bill" passed giving the President troops to compel obedience from South Carolina. The debate between Webster and Hayne, three years before over the right of the states to thus set aside a law of the national government was one of the most brilliant ever heard in Congress. Immediately after the passage of the two laws South Carolina repealed its nullification ordinance.

Quite contrary to Jackson's firm stand in this question was his action when Georgia disregarded the authority of the United States. Georgia had passed a law regarding certain lands which by treaties had been given to the Indians. The Supreme Court of the United States declared that this state law should not be enforced. When a man was imprisoned by Georgia authorities for disregarding the state law, President Jackson refused to use the executive power to uphold the decision of the Supreme Court. Instead he merely remarked: "John Marshall has made the decision; now let him enforce it."

One reason for Jackson's changed attitude was that he hated the Indians and was glad to see them lose their lands. Another was that he was largely guided by his feelings, and he disliked Chief Justice Marshall, the author of the decision in the Georgia affair, as much as he had hated Senator Calhoun, the defender of South Carolina.

When Jackson retired from office he had the satisfaction of seeing his chief points carried: the tariff question was regulated on his principles, the Bank of the United States was closing up its affairs, nullification was laid low, and the Indians in Georgia had been pacified. His satisfaction was increased by the fact that Van Buren, who had been rejected by the

THE HERMITAGE—HOME OF ANDREW JACKSON

Andrew Jackson and his wife, Rachel, loved the trees and gardens that surround their beautiful home, The Hermitage, near Nashville, Tenn. The original brick house was built in 1819, but it burned in 1834 and was rebuilt. The Ladies' Hermitage Association now maintains the house as a memorial to Jackson.

Senate as minister to England, succeeded him as president; and that Roger B. Taney, whom the Senate had once rejected for a lesser office, was the chief justice who administered the oath of office.

Hard times came upon the country in 1837, after Jackson left the presidency. They hurt him financially during the eight years he lived and also disturbed his peace of mind. But they did not destroy his popularity. Admirers named their children for him and asked for his autograph. Because so many wrote asking for a lock of his hair, he kept the clippings whenever he had it cut.

Neither Washington nor Jefferson enjoyed the popularity that "Old Hickory" did; nor have many presidents since his day possessed to such a degree the love and confidence of the majority of the people. He died at his estate, The Hermitage, near Nashville, Tenn., on June 8, 1845, and was buried in the garden.

"STONEWALL" JACKSON

A stern and courageous general, he was honored by the North and South alike.

Jackson, Thomas Jonathan ("Stonewall") (1824–1863). In the whole history of the Civil War no figure stands out more picturesquely than that of "Stonewall" Jackson. His earnestness of purpose and his religious determination to do the right as he saw the right were combined with great military genius. All these qualities made him a man admired alike by friend and foe.

Jackson was born at Clarksburg, Va. (now West Virginia) of Scottish-Irish stock. His father was a lawyer. When Thomas was still a young child his parents died penniless, and he went to live with his uncle. He learned to depend upon himself and secured an education by his own efforts.

After attending a small country school in Virginia, he decided to go to West Point. He set out for Washington, traveling part of the way on foot. When he arrived in the capital, he presented himself before the secretary of war, and asked for an appointment to the Military Academy. The secretary was impressed by the boy's determination and immediately gave him the appointment.

After his graduation in 1846 he served in the Mexican War and won distinction rapidly. In seven months he rose from second lieutenant to major. In 1852 he resigned from the army to teach at Virginia Military Institute. He was not a success in the classroom; but he was loved by the Negroes of the community. He established a Sunday school for them and was unfailingly kind. He was married twice—both times to daughters of Presbyterian ministers. His first wife died in 1854, fourteen months after their marriage. His second wife, whom he married in 1857, bore him a daughter.

He continued teaching until 1861, when the quarrel between the North and the South came to a crisis. Jackson wanted to see the Union preserved, but he believed that the North should not force the South to remain a party to a compact which had become hateful. Therefore he threw in his fortunes with his own people. His record won him a commission as colonel and rapid promotion to brigadier general.

General Barnard S. Bee is credited with giving Jackson his nickname. At the first battle of Bull Run, Jackson's troops held firm when others wavered. Bee rallied his disorganized men with: "There is Jackson standing like a stone wall." Thereafter Jackson was known as "Stonewall."

Stonewall Jackson marched his men swiftly and over long distances into battle. His troops became known as "Jackson's foot cavalry." His strict discipline and long marches tested his men to the limits of endurance. But they admired and loved their commander. They called him "Old Jack" and cheered whenever he appeared, usually in a plain uniform, huge boots, and a weather-beaten cap. In the Shenandoah Valley in 1862, his rapid marches trapped strong Union forces badly needed elsewhere. Soon General Lee entrusted half the Army of Northern Virginia to his command.

In May 1863 at Chancellorsville, Jackson half-circled the Union army and surprised its flank. This attack contributed largely to the Confederate victory. But at dusk, as Jackson and his escort returned from an observation point, one of his own outposts mistook them for a detachment of Federal cavalry and fired. Jackson fell, mortally wounded. His death was a heavy blow to the Confederacy.

Jackson is remembered as a great general and as an earnest and religious man. On the march he carried two books: Napoleon's 'Maxims of War' and the Bible. In the thick of battle his men often observed him move his lips in prayer.

JACKSON, MISS. A surrounding area rich in farmlands, timber, and oil and gas wells has helped Jackson, Mississippi's capital, become the state's largest city and industrial center. The farmlands produce cotton, corn, and cattle, which enter Jackson for processing and shipping. Jackson's factories manufacture cottonseed oil, textiles, chemicals, electric lamps, wood and paper articles, and burlap.

Jackson is located on the Pearl River, with New Orleans 181 miles south and Vicksburg 41 miles west. Thousands of crape myrtle trees lend color to the city. The governor's mansion and grounds occupy a full block in the city's center. Near by is the State Capitol, completed in 1903; it houses the state museum and library. Clustered about the mansion and the Capitol are the old Capitol, the War Memorial Building, and the state fairgrounds. Jackson has three colleges, two for whites and one for Negroes.

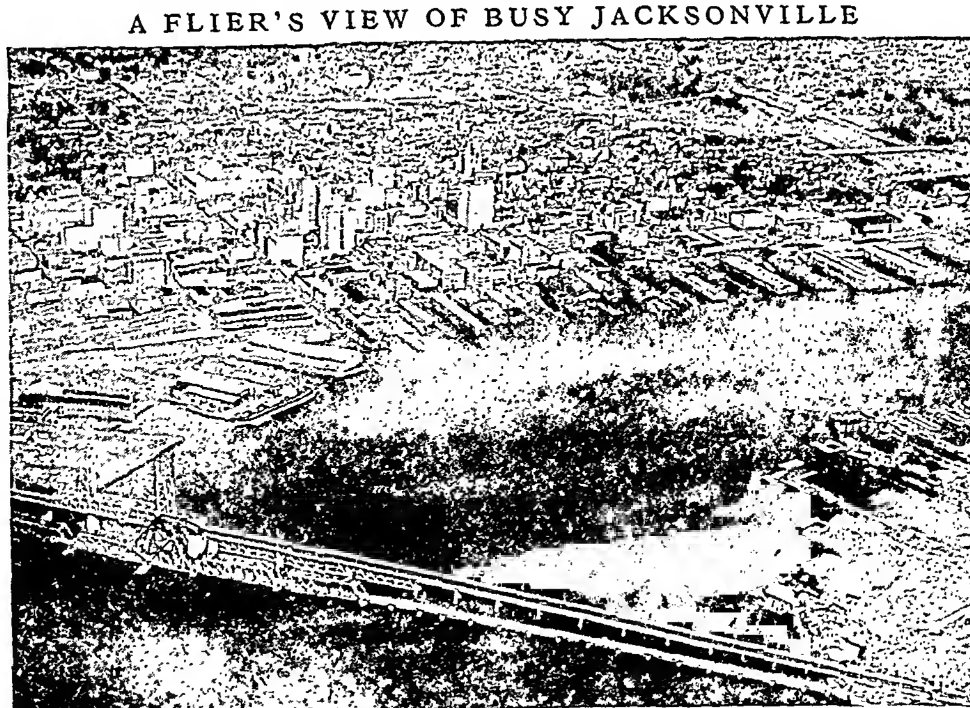
A French-Canadian, Louis Le Fleur, built a trading post here in 1792 called Le Fleur's Bluff. Soon after Mississippi was admitted to the Union (1817), the legislature decided to establish the capital near the state's center. Le Fleur's Bluff was selected as the site. It was renamed Jackson, for Andrew Jackson, hero of the War of 1812 and later president of the United States. The legislature met here for the first time in 1822. Battlefield Park preserves some Confederate fortifications and guns manned against a Federal siege in 1863. During the Union occupation, much of the city was destroyed by fire.

Jackson remained small until after 1900, but then grew rapidly. Oil and gas fields were discovered near by in the 1930's. Besides the offices and institutions maintained by the state, the national government has several agencies here. The city government is the commission form. (*See also* Mississippi.) Population (1950 census), 98,271.

JACKSONVILLE, FLA. The port city of Jacksonville has grown prosperous as a shipping, banking, and industrial center. Jacksonville, in northeast Florida, is located on a bend of the St. Johns River, 18 miles from the Atlantic Ocean. A dredged channel in the river is 34 feet deep. The city's banks finance developments in the state and on the Caribbean islands. Its industries draw on the area's farms and orchards, pine forests, and minerals for raw material.

Jacksonville is a gateway for the country's east coast visitors to Florida's winter playgrounds. Its

A FLIER'S VIEW OF BUSY JACKSONVILLE



Though Jacksonville lies 18 miles inland, it is a large seaport. Beyond the piers, docks, and wharves are the business district and the older residential areas. The bridge in the foreground connects the main part of the city with the newer residential areas south of the St. Johns River.

eight miles of docks receive and ship some 2,500,000 tons a year, much of it in coastwise trade. The tonnage includes petroleum products, logs and lumber, fruits and vegetables, naval stores, and fertilizers. The city manufactures cigars, pulp and paper products, glass, dry ice, and fertilizers.

Jacksonville's business district lies close to the river's north bank; beyond and along the river are residential areas and riverside parks. South and east of the river is a section of substantial homes.

The Indian name for the river ford once at this point was *Wacca Pilatka* ("cows crossing over"). Early English settlers translated the Indian name to Cowford. The American town was founded in 1822 and named Jacksonville for the first territorial governor, Andrew Jackson. Residents have shortened the name to "Jax." In the city's early history the St. Johns River was the chief artery of traffic with the interior. During the Civil War, Southern seamen attempted to run the Union blockade of the port. The city was four times taken and briefly held by Union forces. In the 1880's the channel was deepened to accommodate large vessels. During the Spanish-American War a large army camp was erected here. Today the Jacksonville Naval Air Station is an important air base. Among municipally owned utilities and services are the water- and electric-supply systems, docks, rail terminals, and lumber- and naval-stores yards. The city government is headed by a mayor and has both a council and a commission. (*See also* Florida.) Population (1950 census), 204,517.

JACOBINS. The most powerful influence of the French Revolution was exercised by the Jacobins. Jacobin clubs were formed throughout France to preserve the advances made by the Revolution. Two Jacobin leaders, Robespierre and Danton, helped inaugurate the "Reign of Terror" that disgraced the revolutionary movement. It ended only after Danton and Robespierre were executed.

The Jacobins were formed as the Breton Club in 1789. Its members were Brittany delegates to the National Assembly, then meeting in Versailles, near Paris. Early members—some nobles, many professional men, and a few peasants—were conservatives. The membership was opened to others and the club, later known as the Friends of the Constitution, was joined by many extremists. Many conservative members withdrew or were expelled. Some of these former members became Girondists and advocated a modern form of republicanism.

In October 1789, after the king and the Assembly had moved to Paris, the club occupied a monastery formerly used by Dominican monks. Because the monastery was on the Rue St. Jacques, the monks had been known as Jacobins. The name, first applied to club members in derision, was soon adopted officially. When the radicals Robespierre and Danton became Jacobin leaders, the word "Jacobin" was used as a tag for the most fiery revolutionists.

In the fall of 1792 the Jacobins demanded that King Louis XVI and his queen Marie Antoinette be tried for conspiring with foreign rulers against the Revolution. Over the bitter opposition of the Girondists, the king and queen were tried and executed. Until Robespierre was beheaded (July 1794) the Jacobin meetings influenced French action more strongly than the government assembly. The Jacobin Club was outlawed in November 1794, but its former members continued to exert a strong influence on the government. (*See also* French Revolution; Danton; Robespierre; Louis XVI; Marie Antoinette.)

JAGUAR (*jăg'wär*). This formidable beast of prey is the largest member of the cat family found on the American continent. The average length is about four feet from nose to the end of the tail. It is the tiger of the New World and the third most powerful of the entire cat tribe. The head is noticeably large, the legs massive. There is much variation in its color, but in general it is yellowish brown with black spots like the leopard. The spots, however, are larger and more angular. It inhabits all South America, except Patagonia, and is occasionally found in North America as far as the Red River of Louisiana and the Medina River of Texas. It abounds in the forests, especially along the Amazon, and is the dreaded foe of man and quadrupeds. Its terrific roars at night are enough to frighten even the hardiest person. It hunts both by pursuit and by pouncing on its victims from trees, and is expert at catching fresh-water turtles. Scientific name, *Felis onca*.

JAMAICA. When Columbus saw Jamaica he exclaimed at its beauty. Today it is still a garden land blooming in year-round summer. Cloud-capped peaks rise from the turquoise waters of the Caribbean Sea, and palm-fringed coves stretch back from the shores.

Jamaica (whose Indian name *Xaymaca* means "island of fountains") is truly, a tourist wonderland. Its fields grow orchids, iris, passionflowers, poppies, and wild pansies. Its sparkling streams and jungle lands of palms, bamboos, and giant ferns abound with cuckoos, hummingbirds, parrots, and many-colored butterflies. It is also a land of rich commercial resources, with its luxuriant lowland plantations, its gleaming fruit trees, and its dusky mountain forests of moss-hung logwood, satinwood, mahogany, rosewood, and ebony.

Jamaica's largest trade is with Great Britain. There also is a considerable trade with Canada and the United States. The chief exports are sugar, bananas, rum, tobacco, cocoa, pimentos, and coffee. About 770 ocean-going vessels visit Kingston, Jamaica's chief port, each year.

This largest and most important island of the British West Indies has special interest for the United States. It is a favorite winter resort because of its beauty and mild climate. Its strategic value is great, since it lies only about 550 miles from the Panama Canal and commands vital entrances to the Caribbean Sea. For this reason, the United States in 1940 obtained from Great Britain a 99-year lease of an area southwest of the seaport of Kingston for a naval and aviation base.

Painting by Herman Rountree

MONARCHS OF THE SOUTH AMERICAN FORESTS

For size and ferocity jaguars rank in the cat family next to tigers and lions. Not only do they stalk their prey on the ground but they also pounce on their victims from overhanging branches of trees. Their mottled coats mimic the play of sunlight and leaf shadows in the forest and render them almost indistinguishable at a shorr distance.

Jamaica lies about 90 miles south of Cuba on the main ship route between the Panama Canal, and Europe and the Atlantic states. The island, 144 miles long, 40 miles wide, and with an area of 4,450 square miles (nearly as large as Connecticut), has many good harbors, of which Kingston, the chief commercial port, is the best. It was discovered by Columbus on his second voyage, in 1494, and 15 years later it was settled by the Spaniards. In 1655 it was conquered by an expedition sent out by Cromwell and has since been a British colony. For a few years it was a pirate haunt.

During the 18th century more than 600,000 Negroes were imported to work the plantations, and the island was the chief slave market of America. After an uprising in 1831, slavery was abolished in 1833, but another Negro rebellion occurred in 1865.

TYPICAL PRODUCTS OF JAMAICA

The bananas, the white-clad Negresses, and the broad-brimmed straw hats are all typical of this richly endowed British colony. The picture shows a typical "fruit-store"—a little space screened off in the market place, where the "merchant" sits and sells her wares.

Nearly all the people are Negroes or of mixed blood. Only 2 per cent are white. There are many East Indians, imported for plantation work, and many Chinese. The colony has a governor appointed by the British crown, a privy council, and a legislative council. Population (1949 est.), 1,374,000.

JAMES, KINGS OF ENGLAND. Only two rulers of England have borne the name of James. The hatred which was felt for the second of these, because of his attempt to rule despotically and restore the Catholic religion, is probably one reason why the name has fallen into disuse.

JAMES I, who was king of England from 1603 to 1625, was already King James VI of Scotland when he came to the English throne as the first of the Stuart line (*see* Stuart). He was the son of the unfortunate Mary Queen of Scots and of her second husband, the feeble Henry Stuart, Lord Darnley (*see* Mary Stuart, Queen of Scots). Born in Edinburgh Castle in 1566, he became king of Scotland the following year when his mother was forced to abdicate. During his minority he was a prize to be fought for by warring lords who claimed the regency and by contending French and English factions. In 1582 he was seized by the Earl of Gowrie and the Protestant party and held captive for a year. Upon his escape he began to govern in reality.

As a boy the young king was sickly, and he never outgrew a weakness of the legs which made it impossible for him to stand without support until he was seven. He became a bold rider, although for many years he found it necessary to be tied in the saddle. He was thoroughly educated, especially in theology, and although the son of a Catholic mother remained through life a staunch Protestant. But his large head and rickety legs gave him an ungainly appearance, and he had little of the dignity that befits a king. A foreigner at his court in Scotland once wrote: "He speaks, eats, dresses, and plays a boor."

When James succeeded to the English throne in 1603, on the death of Queen Elizabeth I—his cousin "twice removed"—he was a man of 37 and prided himself on what he called his "king-craft." In reality he so lacked political discretion that a French statesman once characterized him as "the wisest fool in Christendom."

Nearly everything that James did displeased some part of the English people. He aroused their jealousy by a vain attempt to bring about a closer union of his two kingdoms of England and Scotland. He alienated both the Puritans and the Catholics, each of whom had expected concessions from him (*see* Puritans). Some of the Catholics engaged in the Gunpowder Plot to blow up Parliament and the king and bring in a Catholic ruler (*see* Fawkes, Guy). Only one of his acts pleased the Puritans, namely the new translation of the Bible which forms the "King James Version" now in common use.

James I also quarreled with Parliament over taxation and political matters. He believed in the "divine right of kings," that is, that they receive their powers from God and are responsible to Him alone, and not to their subjects. He took the position that Parliament owed all its powers and privileges to the graciousness of the king; while Parliament claimed that these were the "birthright and inheritance of the subjects of England." He quarreled with it, too, over foreign affairs. He wished to ally with the Catholic country of Spain and to marry his son Charles to a Spanish princess. Parliament wanted

to fight Spain at sea, and thus aid the German Protestants in the Thirty Years' War (*see* Thirty Years' War). Not until James' plans for a Spanish alliance failed and he decided to make war upon that country, did he and his Parliament agree. The year after the war was begun James I died, leaving his son Charles I the difficult problems that he himself had been unable to solve.

The Narrow and Stubborn James II

JAMES II, who reigned from 1685 to 1688, was a grandson of James I. His ideas of the "divine right of kings" were the same as those of his grandfather and his father, Charles I. Fortified by the example of Louis XIV in France, he attempted obstinately to carry out his ideas in spite of the fact that his father, Charles I, had been beheaded by Parliament. It has been said of James II that he alienated "not only the classes which had fought *against* his father, but also those that had fought *for* his father."

When James II came to the throne the people welcomed him, and fought for him against a rebellion led by the Duke of Monmouth. But the cruelty shown to the followers of Monmouth at their trial—called the "Bloody Assizes" because of their vindictiveness—turned many against the king.

Then James angered the nation by trying to restore Catholicism as the religion of England. When he came to the throne he had promised to maintain the church "as by law established." The people took this to mean the Established Church of England (Episcopal), and rejoiced that they had "the word of a king, and of a king who was no worse than his word." But they soon learned that James put a different meaning on his word, for he did not consider the Reformation statutes to be valid. He set aside or "dispensed" with the laws against Catholics and Dissenters. Seven bishops protested against reading one of his dispensing proclamations, and James sent them to trial. He appointed many Catholics to office and even named some as bishops in the Church of England. If some of his acts indicated a toleration that was in advance of his age they were merely to aid his fellow Catholics.

How a Baby Brought on a Revolution

At first there was no organized opposition. Waiting seemed wiser, for James was 52 years old when he came to the throne, and his only children Mary and Anne, by his first wife, were both Protestants. But in 1688 a son was born to him by his second wife, who would be the heir to the throne and would be educated as a Catholic and so would prove another Catholic king. Protestant nobles unjustly claimed that the child was not really the son of James and the queen, but was fraudulently smuggled into the palace. They therefore invited James' daughter Mary and her husband, William of Orange, to come from Holland and take the throne of England. When William landed practically everyone, even his daughter Anne, deserted James, and he fled to the continent. This was the "glorious revolution of 1688."

James fled to France, where he was cordially received by Louis XIV, who had been furnishing him money to carry on his fight for absolute power and Catholicism. The French king now gave James a pension and support in trying to recover his throne. But James was defeated in Ireland at the Battle of the Boyne (July 1, 1690) and the French fleet was crushed at La Hogue in 1692. James then gave up actively trying to regain his throne. He lived quietly in France, where he died in 1701. (*See also* Pretender; William, Kings of England.)

JAMESTOWN, VA. On May 14, 1607, about a hundred men sent by the London Company founded the first permanent English colony in America. They had arrived the day before in three small ships—the *Goodspeed*, the *Discovery*, and the *Sarah Constant*. The place they had chosen to settle was a marshy peninsula (an island at high tide), 30 miles up a river which they named the James, for King James I. There they built a fort and a few miserable huts. Some lived in caves.

The site was low and unhealthful, and many soon died. A supply ship bringing additional colonists eight months later found only 38 of the original 105 alive. Attacks by Indians, famine, and trouble over the system of holding property in common added to their difficulties. Only the efforts of burly, bragging, but efficient Capt. John Smith had kept the colony together. The winter of 1609, following Smith's return to England, was known as the "starving time." When the disheartened colonists sailed for England, they met the supply ship of the new governor, Lord de la Warr (later spelled Delaware), and they returned. In 1612 they began tobacco growing and fared better.

In 1619 three important events occurred. The first legislative assembly in America was formed. Two women had come in 1608, but now a shipload of prospective wives arrived. And the first Negro slaves landed.

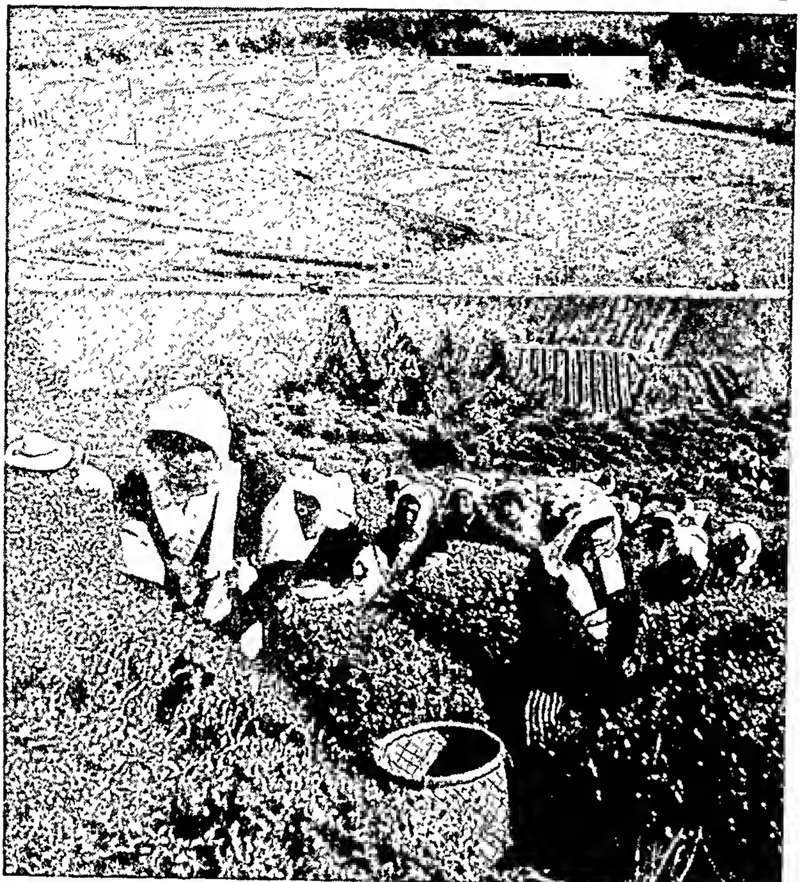
The town had disastrous fires in 1608, in 1676, and again in 1698. Jamestown was the capital of the Virginia colony until it was abandoned in 1699 and the capital moved to Williamsburg. Buildings crumbled, leaving only foundations and the brick church tower.

Since 1893 the Association for the Preservation of Virginia Antiquities has worked to preserve historic Jamestown. It now owns a beautiful 22-acre tract, visited by thousands of tourists annually. The rest of the site is part of the Colonial National Historical Park. (*See also* National Parks; Smith; Virginia.)

JANUARY. More than 150 years before the Christian era, January was the first month of the year in the Roman calendar. It was named from Janus, the "two-faced" god who in the Roman mythology presided over the beginning of things, and was the doorkeeper ("janitor") of heaven. The so-called temple of Janus, which was simply a gateway in the Roman Forum, was open in war and closed in peace.

During the Middle Ages the year began at various dates in different times and places. In England it was not until 1751 that January was restored to its place as first month. (*See* Calendar.)

Crowded JAPAN — *Workshop of* ASIA



The Japanese make up in hard work for the small amount of farmland on their mountainous islands. Here carefully tended, irrigated rice fields fill the alluvial valley and tea grows on the hillside. The many tea pickers see that not a leaf is wasted.

JAPAN. The Japanese people—skillful, hardworking, adaptable—have been called Japan's richest resource. The country is small—four beautiful, mountainous islands and a host of islets set in the blue Pacific off the east coast of Asia. Farmland is scarce, mineral wealth limited, the population large and growing. Only by the most efficient and ingenious use of every resource can the people meet their needs.

The Japanese demonstrated their adaptability between 1853 and 1953, for that single century brought to them more changes than many countries experience in a thousand years. In 1853 Japan (*Nippon* in Japanese) was a "hermit nation" that barred foreigners and their goods. Workers tilled the soil and made fine wares by tedious, backbreaking hand methods passed down from ancient times. Their government resembled the feudal systems of medieval Europe.

In 1853 Commodore Matthew C. Perry sailed into Yokohama harbor with a United States flotilla and demanded that the nation open its ports to American trade. The Japanese sent missions abroad to study the Western world and its industrial civilization. They built factories using strange, new machinery. They adopted universal elementary schooling to educate workers for industry and trade. Their low-priced goods found foreign markets, and with their new wealth they built a big army and navy. Successful wars with China and Russia made Japan a world power.

With militarists in power, the Japanese took the path of conquest to gain colonial markets and raw materials. Flushed with victory over weaker neighbors, they entered World War II with an attack on the United States at Pearl Harbor in December 1941. They overran a rich empire in Asia and the Pacific islands before America was able to throw the full force of its military and industrial might into the war. Then came total defeat for the Japanese, who surrendered Sept. 2, 1945.

While American forces occupied the country, Japan adopted a democratic constitution. Its people sought to learn the true meaning of democracy and to develop a democratic way of life that would bring them greater liberty and abundance. Japan regained its sovereignty in 1952 after a peace treaty had been signed. The end of their fateful century found the people faced with the task of restoring their war-shattered cities and industries and regaining foreign trade to supply the food and raw materials they require.

Nature of the Land and Climate

JAPAN IS part of a scallop of islands in the Pacific Ocean fringing the coast of Asia. The four main islands—Hokkaido, Honshu, Shikoku, and Kyushu—stretch from north to south about 1,300 miles between 45° and 31° north latitude. In the

Extent.—Length of island chain, north to south, about 1,300 miles (from 45° N. to 31° N. latitude); greatest width, 170 miles (from 130° E. to 146° E. longitude). Area of four main islands (Honshu, Hokkaido, Kyushu, and Shikoku) and adjacent small islands, 142,640 sq. mi. Population (1950 census), 83,413,723.

Extent of Prewar Empire.—Four home islands, Kuril and Ryukyu chains, 147,611 sq. mi.; Korea, Formosa, Japanese Sakhalin, and Pescadores, 113,000 sq. mi.; Kwantung Leased Territory on Liaotung Peninsula of Manchuria, 1,300 sq. mi.; former South Sea Mandated Territories (the Marianas, Marshall, Palau, and Caroline islands), about 800 sq. mi. Total area, about 260,000 sq. mi. Population, about 100,000,000.

Natural Features.—Three quarters of surface of islands mountainous or hilly; principal range, Hida Mountains, or Japanese Alps; highest peak, Fujiyama (Mount Fuji), 12,461 ft.; nearly 200 volcanoes, about 50 active. Short swift rivers and mountain lakes. Island-studded Inland Sea between Honshu, Kyushu, and Shikoku. Indented coast line with good harbors. Climate humid, varying from semitropical in south to harshly cold in north.

Products.—Rice, barley, wheat, sweet potatoes, vegetables, raw silk, tea, fruit; fish and shellfish; lumber and pulpwood; coal, sulfur, pyrites; cotton, rayon, silk and wool yarn, and fabrics; chemicals, fertilizers, ships, iron and steel, machinery, pottery and tableware, toys.

Principal Cities.—Tokyo (capital, 5,385,071), Osaka (1,956,136), Kyoto (1,101,854), Nagoya (1,030,635), Yokohama (951,189), Kobe (765,435).

southwest the chain lies but 100 miles from Korea and some 500 miles from the shore of China. The greatest width of the islands measures 170 miles.

The Japanese have been crowded into the four home islands and a few adjacent small islands since they lost their empire. The total area is but 142,640 square miles, and the population 83,413,723 (1950 census). Honshu, the main island, contains about 60 per cent of the area and some 75 per cent of the people. The nation is only two thirds the size of France yet it holds more than twice as many people. Compared to the most densely populated census region of the United States—the northeastern states from Maine to New York and New Jersey—Japan has about five sixths its area and well over twice its population. With some 575 persons to the square mile, it is the third most densely populated country in the world. The difficulty of supporting so many people in so small an area is intensified by the mountainous character of the islands. The density of population per square mile of arable land is the highest in the world—more than 3,500.

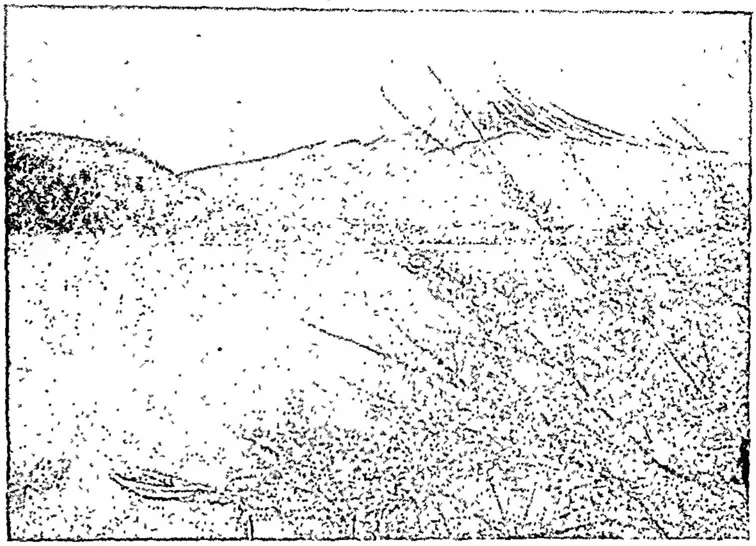
A Land of Mountain and Seacoast

Three quarters of Japan is mountainous or hilly. Geologists divide the mountain chains into an Outer Zone of young parallel ridges on the Pacific side of the islands and an Inner Zone bordering the Sea of Japan. Along the Inner Zone stretch a series of fault block plateaus, eroded into steep hills and peaks, where summits of 6,000 feet are common. In the depression between the two chains lies the Inland Sea, which separates southwestern Honshu from Kyushu and Shikoku. The highest and most rugged mountains rise in the Japanese Alps, or Hida Mountains, of Central Honshu, west of Tokyo, where numerous peaks reach 10,000 feet.

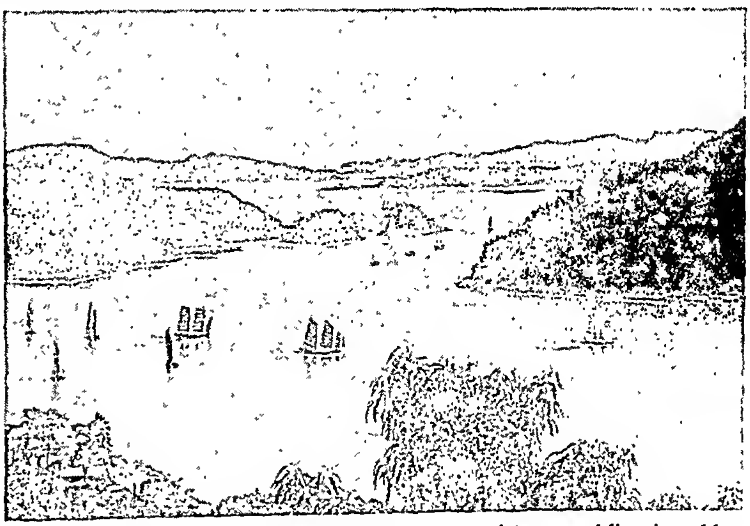
East of this knot a lowland, or rift valley, known as the Fossa Magna, crosses the island from north to south. From it rise volcanoes that almost fill it with their piles of cinders and lava. Highest is the perfect cone of Mount Fuji (also called Fujisan or Fujiyama), 12,461 feet in altitude. Five lakes mirror its beauty. The Japanese revere Fuji, and in summer when its cap of snow has melted thousands of pilgrims climb to the quiet crater. Japan has some 192 volcanoes, about 50 of which have been active in recorded time. Hot springs are numerous.

The islands lie in the earthquake belt found along the margin of the Pacific

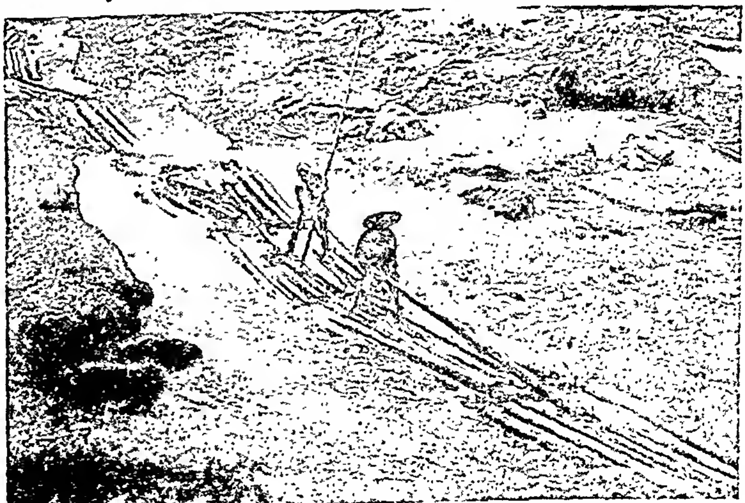
MOUNTAIN, SHORE, AND DASHING STREAM



Mount Fuji, tallest of Japan's many volcanic cones, is revered by the people. Here we see it through a screen of cherry blossoms, a favorite spring flower. The beauty-loving Japanese make pilgrimages to view scenes like this.



Forested hills sloping to a rocky beach and green islets sparkling in a blue sea give Japan one of the world's loveliest coast lines. In this view from Kyushu's west coast, fishing vessels are putting out to sea.



Here we see a long raft shooting the rapids in a mountain stream on its way to a coastal lumber mill. Japan's swift rivers are rarely navigable, but they are harnessed to make electricity and used for irrigating valley farms.

Ocean. In a year, 1,500 or more minor shocks may be recorded. Destruction is enormous when the earthquake center covers a large city. This happened on Sept. 1, 1923, when Tokyo and Yokohama were devastated and more than 90,000 people lost their lives. Quakes beneath the sea bring destructive tidal waves.

Plains and basins level and fertile enough for farming are scarce on these mountainous islands. Only 16 per cent of the country is suitable for cultivation. The level land occurs on coastal plains and in small, scattered inland valleys amid the uplands. The chief lowlands are the Kanto plain near Tokyo, the Kinai plain around Osaka and Kyoto, the Nobi plain near Nagoya, the Echigo plain near Niigata on the west coast of northern Honshu, the Sendai plain in the northeast, and the following in Hokkaido: Ishikari, Tokachi, and Nemuro. Sixty-five per cent of the people of Japan crowd its few lowlands.

Lakes and Tumbling Rivers

Myriad short, swift streams course down the Japanese mountains, dropping from cliffs in lovely waterfalls and biting deep gulches. They bring water to irrigate the lowland rice fields, and their rapids and falls have been harnessed to produce hydroelectric power. All rivers are short—only three measuring more than 200 miles—the Ishikari on Hokkaido, the Tone and Shinano on Honshu. A few are navigable for short distances by flat-bottomed boats. Floods in the rainy season cause severe damage to irrigated fields. The silt carried by the streams has built many river beds up to the level of the surrounding land or higher, and dikes are constructed to hold the water. Many small lakes nestle amidst the mountains. The largest is Lake Biwa, near Kyoto.

Harbors on Busy Sea Lanes

Japan's location helps to make its many-harbored, 16,000-mile coast line a valuable asset. It lies on the great circle route from North America to Asia, and hence is a port of call for steamship and air routes from the United States to leading Asiatic ports. The north Pacific trade routes meet those from Europe and the East Indies in Japanese waters.

The Pacific Ocean coast line is more irregular than the Japan Sea coast, and its bays make good harbors. The west coast of Kyushu affords harbors on the East China Sea facing China. The Inland Sea has many inlets and bays to shelter foreign and domestic shipping and fishing fleets. Many of the country's chief commercial and industrial cities are here.

A Moist, Mild Climate

Since Japan stretches over 15 degrees from the latitude of Maine to that of southern Georgia, it has a variety of climates. The broad southern part of the country is subtropical. Humidity is higher there and the weather tends to be warmer than at corresponding latitudes in the American cotton belt or in China, but cooler than comparable parts of Italy or Greece. Japanese civilization had its origin in the south, and the greatest concentration of people is at the latitude of the Carolinas. The Japanese have adapted their clothing, housing, and farming methods to a warm climate. Their way of life is not well suited to colder regions, and they are not comfortable even in the fairly mild southern winters.

Hokkaido, the northernmost island, has bitter winters, with mean temperatures below 32°F. for four months. Northern Honshu usually has two months with a below-freezing average temperature.

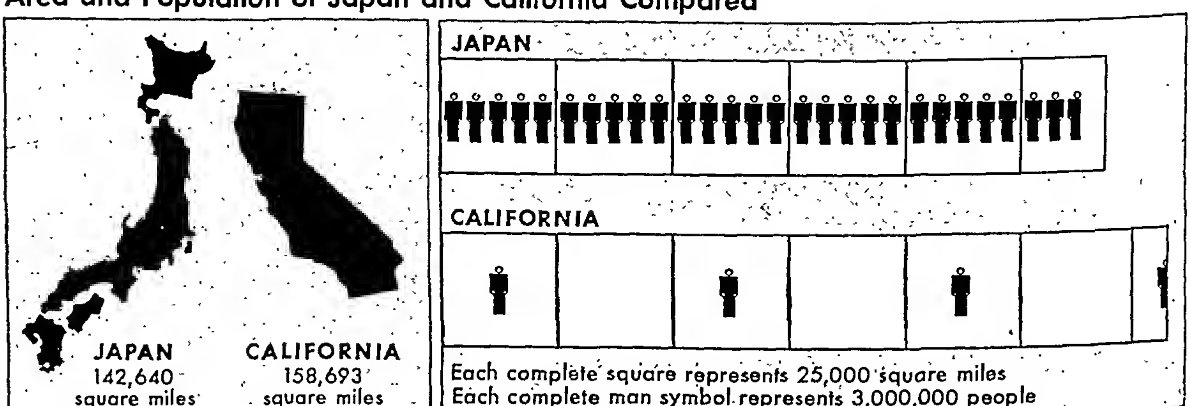
Ocean Currents, Monsoons, and Typhoons

Temperatures and rainfall are greatly affected by winds, ocean currents, and altitude. A warm ocean current, called the Kuroshio (Black Current, or Japan Current), flowing from tropical waters, divides as it reaches the islands. The western branch enters the Japan Sea. The eastern branch bathes the southeast coast and turns out into the Pacific near Tokyo. The cold Oyashio (Okhotsk Current) from the north chills the shores of Hokkaido and northern Honshu.

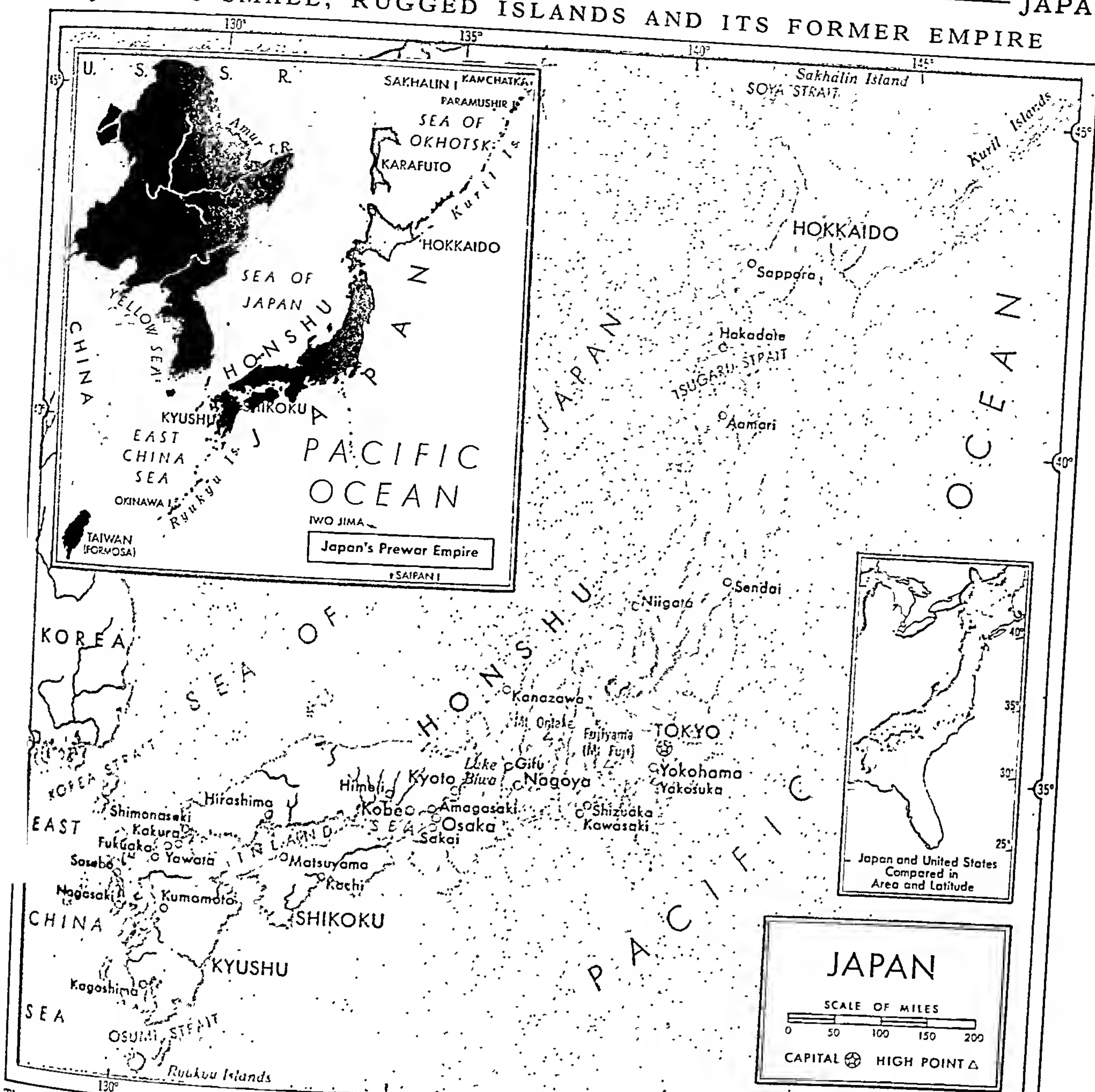
Japan gets most of its rainfall from the monsoon winds. The summer monsoons blow in from the warm ocean at the southeast, laden with moisture. In June and July come cloudy, sultry days and the prolonged gentle rains known as the plum rains. August is generally the hottest month. In September, typhoons from the China Sea may bring heavy rains and destructive storms (*see* Storms; Winds).

The winter monsoons roar in from the cold heart of Asia in the northwest. They absorb warmth and

Area and Population of Japan and California Compared



JAPAN'S SMALL, RUGGED ISLANDS AND ITS FORMER EMPIRE



The large map shows the Japanese islands' rugged surface, short rivers, and narrow coastal plains. The thickly peopled industrial area is indicated by the strip of cities from Tokyo to Nagasaki. On the insert at right, the map of Japan has been superimposed on that of the eastern United States. Notice that Japan's most densely populated area is at the latitude of the Carolinas. The top map shows Japan's prewar empire. (For world position of Japan, see maps of Asia and Pacific Ocean.)

moisture as they pass over the warm current in the Japan Sea and drop a heavy blanket of snow as they rise over the western mountain ranges of northern Honshu and Hokkaido. The snow cover lasts throughout the winter there. Eastern Japan enjoys more numerous sunny winter days, and, except in the far north, the snows melt rapidly.

Virtually the whole country gets abundant moisture either as snow or rain, and some eastern stations measure as much as 125 inches a year. In a few places, where mountain ranges shelter interior basins, the rainfall may drop to 40 inches a year. Altitude affects temperatures too. A relatively short rise separates steaming rice fields from mountain peaks that are covered with snow much of the year.

Forests and Flowers of Japan

The beauty and variety of the forests and other vegetation in Japan reflect the wide range in latitude, altitude, and climate. About half of the country is wooded.

Forests of fir and spruce grow in chill eastern Hokkaido and cover the summits of northern Honshu's mountains. Mixed forests of maple, birch, beech, poplar, oak, fir, cryptomeria, pine, hemlock, and cedar in the mountains of western Hokkaido and northern Honshu are the chief source of Japan's large output

of lumber. To the south various trees of the temperate forests find suitable climates at different altitudes, and the southern lowlands grow palms, broad-leaved tropical evergreens, and bamboo.

Japan has been called the Flowery Kingdom. The people are noted for their love of nature, and they have contributed hundreds of flowering shrubs and trees to the gardens of the world. In the spring they make pilgrimages to admire the blossoms on wild fruit trees, and in the fall they go to view the colored foliage of maple, oak, and birch trees. Each month has its favorite flowers. The cherry and other fruit blossoms of early spring are followed by wistaria, then come the azalea, iris, and peony. In summer the lotus drops red and white blossoms on the lakes, and autumn finds a profusion of chrysanthemums and the brilliant autumn leaves.

Japanese plants and animals are related to Asiatic varieties. Large animals are rare, though there are bears and a few wolves. Badger, otter, marten, ermine, and Japanese mink furnish furs. Rodents are abundant, and there is one monkey, the tiny macaque. About a third of the birds are waterfowl. The waters surrounding the islands are the home of the whale, seal, and walrus. These seas, with their mixture of hot and cold currents, nourish an abundance and variety of aquatic plants and teem with fish and shellfish. The waters surrounding Japan are the world's greatest fishing grounds.

The People of Japan

THE JAPANESE are a Mongoloid people with straight black hair, yellow to brown skin, round faces, and high cheek bones. They resemble their neighbors the Chinese and Koreans, though they tend to be shorter in stature. Anthropologists believe they began migrating to the islands by way of Korea some 3,000 years ago, settling first in Kyushu and southwestern Honshu. Since the Japanese have physical and cultural resemblances to the Malayan peoples, it is possible that migrants may have come from southeast Asia as well as from the north.

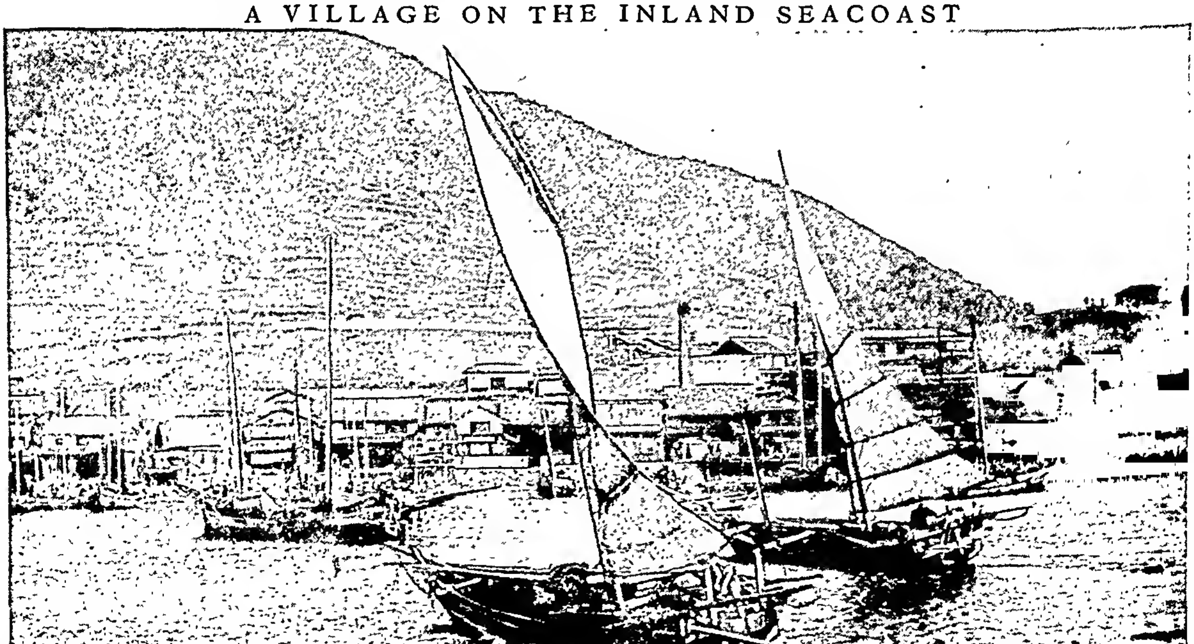
On the islands they found another people—the Ainu, with fair skins and abundant hair and beard. Over the centuries the Japanese drove back these folk, exterminating or assimilating them. Now only a few thousand remain on Hokkaido as wards of the nation.

Japan shares with the other fertile lands of Asia the problem of overpopulation. The population had stood at about 30 million for two centuries before

JAPAN'S FIRST INHABITANTS

Bearded, fair-skinned Ainu men greet each other with ancient, traditional rituals before a thatched hut on Hokkaido. Their people once occupied the islands but were driven back by the ancestors of the modern Japanese.

A VILLAGE ON THE INLAND SEACOAST



Villagers work at fishing and farming to make a living here. They have terraced the lower slope of the hill, and they cultivate the land almost to the water's edge. The wooded upper slopes supply kitchen fuel. Along the beach the houses are huddled together to save space. The two vessels under sail are bringing in the catch after a fishing voyage.

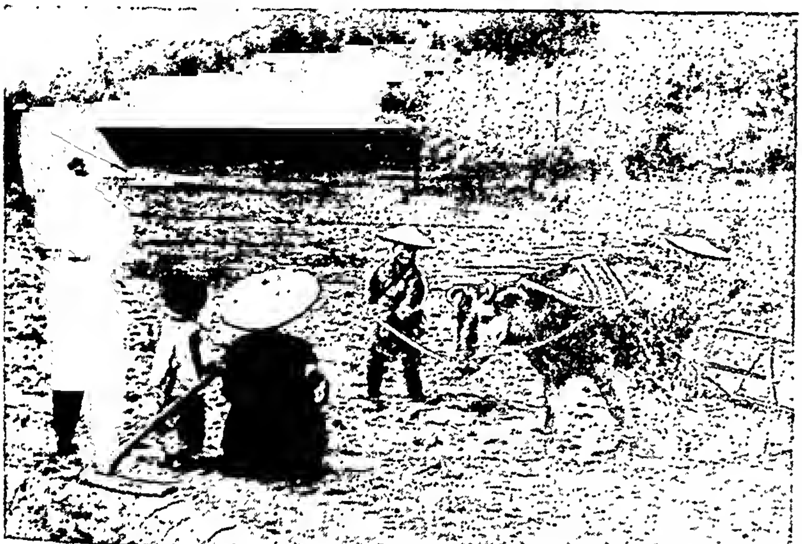
the country was opened to world trade. Then it more than doubled by 1930 and is today increasing by a million or more persons each year.

The Shinto and Buddhist Religions

The two chief religions are Shinto and Buddhism. Shinto is a combination of nature and ancestor worship. All Japanese believed themselves to be descendants of the sun-goddess Amaterasu and to be members of one family headed by the emperor. Shinto shrines contained no images, but in the veiled interior were the symbols of the sun-goddess—a mirror, a sword, and a jewel. Every home had its miniature shrine. People could observe Shinto rites and still accept another religion. This was done by millions of Buddhists and many Christians. Shinto originated in early Japan, while Buddhism was introduced from China in the 6th century A.D. (*see* Buddha). Both have many sects and subsects. Buddhism was the stronger religion until 1867 when Emperor Meiji began his reign and Shinto became the state religion. As nationalists and militarists gained power, they adapted it to their purposes. The people were taught that their race was destined to rule the world.

After World War II state support of Shinto was abolished, and the emperor disclaimed his divinity. The 1946 constitution guaranteed freedom of religion. Only about one half of one per cent of the people are Christians.

WORK FOR EVERYONE IN THE FARM FAMILY



It is spring, the winter crop has been harvested, and the family has come to the rice paddy to work its soil to a mushy consistency. The women have mattocks for grubbing out the roots. The man guides a crude harrow pulled by a cow.

It is harvest time. The family has reaped the millet with a hand sickle and cut the heads from the stalks. The heads are spread on the hard-packed courtyard floor. Father, mother, and sons are beating the millet with heavy flails to thresh the grain.

How the Rural People Live

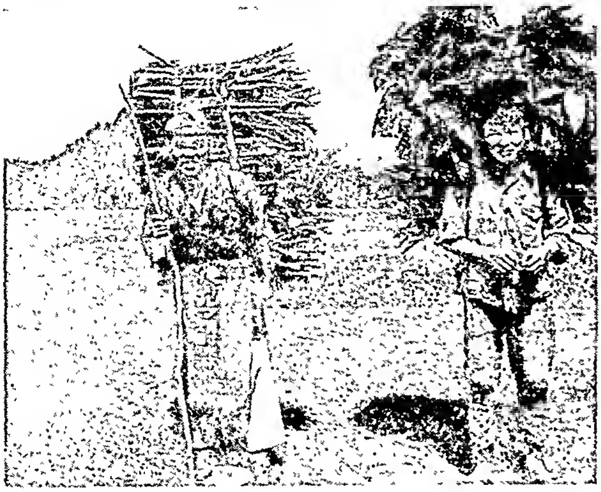
Half of the Japanese are rural folk who depend on farming for a livelihood. To raise enough to eat they must work very hard on tiny farms, averaging less than two and one half acres. Their small fields are not suited for cultivation with farm machinery, and the work must be done by hand, aided perhaps by a single horse or cow. To add to their small incomes, farmers often work on fishing boats part of the time or hire out as day laborers.

Farm families dwell in country villages, usually crowded against the hillside or set on a sandy beach to save every inch of level land for fields. The steep thatched roofs and earthen or unpainted clapboard walls of the houses blend into the landscape. Houses are usually small, though the households are large. They commonly consist of the farmer's own family, together with the wives and children of his grown sons. The kitchen is a lean-to with an earthen floor, where twigs and straw are burned in a large clay or brick firebox for cooking.

Inside a Japanese House

Most houses perch on two-foot posts set into rock foundations. A narrow porch along the sunny side serves as a hall into which the rooms open. Permanent partitions are rare. Sliding walls made of paper-covered frames may be closed to create separate rooms or opened to convert the entire house into a single room. Sliding outer doors are pushed back on summer days to let in the air and are shut for protection at night. These houses, with their flimsy, airy construction, are well suited to a warm climate and to a region where earth-

NOT A STICK OR STRAW IS WASTED BY THE FRUGAL FARM FOLK



These young men are carrying loads of sticks and leaves from the wooded mountains. The sticks will serve as kitchen fuel and the leaves go into a compost heap for fertilizer.

This farm girl is using her "spare time" to plait straw for the sandals she makes. Sold in the village market, they will add a few yen to the family's meager income.

quakes destroy sturdier structures; but they do not keep out winter's damp chill.

A charcoal brazier, called a *hibachi*, gives forth a bit of warmth. Sometimes a burner is set down into the floor and a table placed over it, draped with quilts. The family gather around it to warm their feet. At night the bedding is spread fanwise on the floor around the heater.

Japanese homes do not have bedsteads and chairs, but their floors are softer than those in American houses. They are made of straw mats two inches thick, three feet wide, and six feet long, which rest on the joists. The padded quilts placed on the floor for sleeping and the pillows on which the family kneel are stored in closets by day. The mats—called *tatami* —must be kept very clean, so everyone removes his shoes at the door.

Food for the Family

The housewife and her daughters-in-law rise very early to set the rice cooking for the morning meal. Rice is usually served three times a day—twice cold to save fuel. Farm families are fortunate to have brown rice, which they have threshed and winnowed by hand. City people prefer polished white rice, but it contains fewer vitamins. Many farmers cannot afford to eat the rice they raise. They use the coarser grains, such as barley and millet. Widely eaten vegetables include soybeans, beans, giant radishes (*daikon*), cabbage, white and sweet potatoes, onions, carrots, and bamboo shoots. Meat is found on few tables. Raw or cooked fish or shellfish is eaten at most meals, while chicken and eggs are used sparingly. A favorite food is *tempura*, a fish or vegetable covered with dough made of wheat flour and eggs and fried in a pan of boiling oil.

The women carry the food from the kitchen on individual trays, which are placed on low tables. Kneeling on a cushion beside the table, each person eats the solid foods with chopsticks and drinks soup and tea. In the better homes, the dainty appearance of the trays is most important, and the family cherishes a collection of handsome, lacquered soup bowls and porcelain tea cups.

Work on the Farm

After breakfast, the farmer trudges off to one of his widely scattered fields. The Rice article describes the many backbreaking tasks involved in raising this principal crop. While the rice fields are flooded he works all day standing in water.

COOKING IN JAPAN

Preparing a meal at her brick firebox, the housewife ladles hot water from the pot at her right into a kettle to make tea. The heavy rice pot at her left gets daily use.

His wife and all but the youngest children help with such jobs as transplanting, weeding, and cutting the grain with hand sickles. The wife works with her baby strapped on her back unless there is an older child to carry the little one. Small boys enjoy the job of rattling cans or other noisemakers to scare the birds away from the grain. They carry lunch to the field workers and catch grasshoppers and other insects. Young people in their teens do a full day's hard work.

When the women are not needed in the fields they find many chores at home. In the fall they harvest vegetables and fruits raised in small gardens and orchards. They prepare the winter's supply of soybean sauce and paste, dry sliced sweet potatoes and persimmons, and pickle the big radishes. Then there are always sewing, cleaning, washing, and patching the paper partitions of the house.

Many farm families raise silkworms in their homes (*see* Silk). In the season when the caterpillars are eating, everyone keeps busy carrying in a huge supply of mulberry leaves and cleaning the trays on which the insects live. At one time the women also unwound the cocoons at home, but they are usually sold to a factory for reeling today.

There is no winter leisure for the Japanese farmer. As soon as the rice is harvested he plows and plants a crop to grow in the mild winter. Before snow covers the mountains he must find time to plod up the slope and cut brush for the kitchen fire. Everything must be saved and put to use. He uses the rice straw to weave sandals, hats, or rope, and to patch the thatch of his roof. Straw, plant stems, fallen leaves from the forest floor, vegetable peelings, and human and animal manure are collected in a compost heap to make *fertilizer* for the worn land.

Village Work and Play

The people of the village co-operate in many tasks. They may work together at plowing or in building a house. They join in working on roads, bridges, or irrigation ditches and in maintaining temples and shrines. They man a fire watch to catch any blaze in the thatched roofs before it wipes out the community. They band together in co-operatives to market or process their produce. The villagers share one another's joys and sorrows too. The whole village may take part in a wedding or a funeral. The women help with the preparation of food for a celebration, and everyone brings a small gift or contribution.

Neighbors may share the work, expense, and relaxation of the evening bath. In the bathhouse stands a large earthen or cedar tub. The women draw water from the well and kindle a fire beneath the tub to keep the water hot. Then each member of the family in turn—beginning with the father—washes and rinses thoroughly before sitting in the tub. In winter the hot water gives them the first real warmth of the day, and in any season they enjoy the rest.

Neighboring farmers may discuss crops or plowing as they soak, and later the women and children chat together. The Japanese feel no embarrassment at bathing together. In cities, community bathhouses contain a large tank where a dozen neighbors may bathe and visit together in the relaxing warmth.

DINNER IN A CITY HOUSEHOLD

The family kneel on the tatami-covered floor to dine at the low table. Bowls of rice and soup and small dishes of fish and fried dumplings make up the meal. The children appear expert at eating with chopsticks, though they are in Western dress. The parents wear kimonos.

How the City People Live

Japanese cities are a mixture of the Orient and the Occident. In the business sections stand tall office buildings of steel and concrete, modern stores and motion-picture theaters, and huge industries. Nearby streets are lined with shops and *family factories* where the craftsmen live, work, and sell their wares.

City houses are similar to those in the villages, but tile roofs take the place of thatch. The people do not lose their love of nature when they move to a city, so the garden is the center of the home. Expert gardeners, they create miniature landscapes with small

GEISHAS DANCING TO SAMISEN MUSIC

Dinner at a geisha house is the traditional recreation of well-to-do city men. The rich silk kimonos and ornate headdresses worn by geisha girls are the styles of old Japan.

trees, flowering bushes, pools, streams, and bridges. By opening the sliding door to the garden it seems to be part of the house. Families too poor for a garden cherish a potted dwarf tree or other plant.

The most important spot in the house is the *tokonoma*, an alcove where a low platform holds an exquisite flower arrangement. Above it hangs a painted scroll. When callers come, the most honored guest is seated nearby.

City life, like the architecture, is a mixture of East and West. Western customs increased greatly while American forces occupied the country following World War II. Most women tend to follow traditional customs, though the 1946 constitution gave them the right to vote and 30 were elected to the Diet in the first election. They are expected to serve and obey their fathers and husbands, and even their sons. They are kept close to home by convention, by their duties to their rather large families, and by home tasks done in old-fashioned ways. The mother may have a great deal to say about the management of the household, though the father rules in the family. In such important matters as the marriage of a daughter, the adoption of a son to carry on the family name, or the erection of a new house, a family council may be called.

City Customs and Amusements

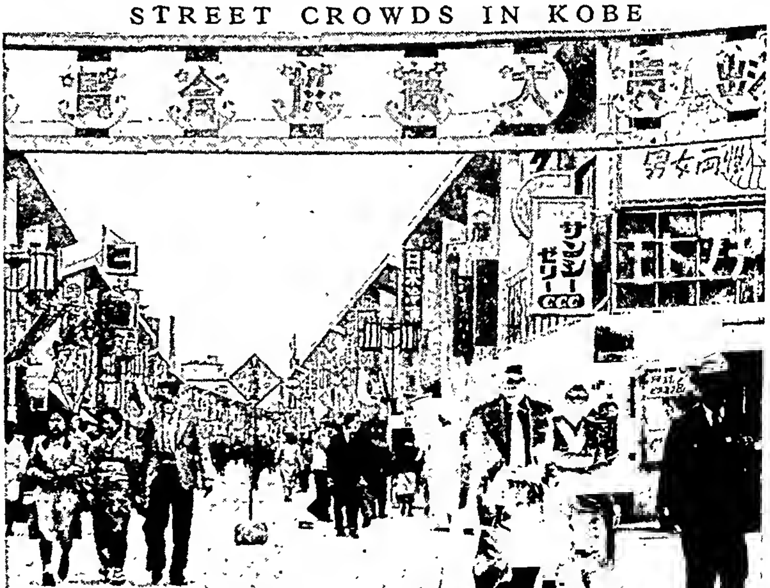
When a family moves into a new neighborhood, the man is expected to call on the nearest neighbors with a small gift. In turn representatives of community organizations call to explain arrangements about garbage collection, night watchmen, and the like. The policeman comes to see that the register of family names is on file at the police station. Several times a year the policeman sets a day for house cleaning. Then the housewife takes furnishings and tatami out and scrubs until everything is spotless.

Calls and entertaining in a Japanese home tend to be formal and surrounded by rigid rules of etiquette. Everyone in the family greets the guests with a deep bow. In the tea ceremony, described in the article Tea, every move and attitude of host and guest follow age-old rules. When refreshments are served, a caller compliments the food by tucking a confection into his kimono sleeve to take home.

Townspeople find neighborly sociability at the bathhouse, in an evening stroll along the crowded shopping streets, and in community activities. The men also seek entertainment in teahouses and beer halls. Wealthier men may banquet friends and business associates at geisha restaurants. Here they are entertained by geisha girls, gowned richly in silk kimonos, with their hair elaborately dressed. They dance, play the *samisen*, sing, recite poetry, and chat with the guests. These young women go into training in childhood to learn perfectly the traditional dances, songs, and charming mannerisms of their profession (*see* Dance, subhead "Japanese Dance Drama").

Family outings are frequent. Parents take their children to the Shinto shrines and Buddhist temples for the numerous festivals. They throng the parks and amusement centers to enjoy the varied rides and treats. They crowd on excursion trains that take them to beauty spots to view the cherry blossoms or the autumn foliage.

STREET CROWDS IN KOBE



City families find recreation in strolling along the city streets and stopping at the open fronts of the shops. Most people here have adopted Western attire, but the two women in front are wearing pretty kimonos, sandals, and *tabi*.

The men and boys go to baseball and ice hockey games, swimming and tennis matches, and bicycle races. Wrestling has been a favorite sport for centuries. Two forms of the sport are *sumo* and *judo.*

Styles of Clothing

City men—especially those in business—have adopted Western clothing. When they come home in the evening, however, they find a kimono more comfortable. Most children wear Western style clothes in school, and the younger women follow the latest fashions avidly. Housewives, however, cling to the kimono, as do most country people of both sexes. The women's garment is ankle length. It is tied at the waist with a sash, the *obi,* which is a broad strip of cloth made into a huge bow at the back. Farm women tie back the flowing kimono sleeves and tuck up the skirts when they work in the field.

The men's kimono is short, dark or drab in color, and usually worn over tight-fitting trousers. With Japanese apparel everyone wears wooden clogs, called *geta,* or straw sandals. Short socks, or *tabi,* have a separate place for the big toe, so the sandal strap may be held between it and the other toes.

The materials in Japanese garments range from rich silks and brocades to cotton. Little girls wear clothes with very bright patterns. The colors and designs for kimonos become darker and more conservative as the women grow older. The *yukata* is a loose cotton garment which is worn on hot summer evenings. Designs in blue on a white background make it appear cool. Workmen sometimes wear the *happi,* a short blue cotton jacket bearing the insignia of the worker's trade, with tight coarse cotton trousers, which are called *momohiki.*

Short haircuts came into fashion for men in the 19th century. Bobbed hair, permanent waves, and Western styles are favored by most modern women. The elaborate headdress once worn is seldom seen today except at weddings and other ceremonial affairs or in the theater and geisha house.

Growing up in Japan

A JAPANESE baby spends most of his first two years riding about on the back of his mother or an older sister, held safely by broad sashes. This gives him a secure feeling of being loved and cherished, but physicians say that the position may tend to bow the legs and stunt their growth.

Japanese parents are very fond of their children and give them a great deal of attention, but they begin training them in obedience very early. The fragile Japanese house is not suitable for a rowdy child. He must learn not to tear the paper partitions, not to touch the vase on the tokonoma, not to burn himself on the hibachi, and to keep clean and neat even while feeding himself with chopsticks. He is punished if he does not obey, and so the child learns early that he must do as his elders say and must treat them with respect.

At about the age of three or four, the difference in the treatment of boys and girls becomes noticeable. Little girls realize that they must defer to their small brothers as well as to their elders. It is so important to the parents to have sons to carry on the family name that boys are preferred and pampered. They may "boss" their older sisters or even their mother. On the other hand, the father expects more of a boy, and he is brought up with the obligation to do nothing to harm the family reputation.

Though the mother is not free to punish the boy, she is able to influence him through his fear of being laughed at. The child's sensitivity to ridicule develops into the adult's dread of "losing face."

PRIDE AND LOVE SURROUND THE JAPANESE BABY

At left, a father hangs a paper bearing the name of his baby on the Buddhist shrine in his home. Thus he tells his ancestors of the new arrival. At center, a mother lays her baby in the bed they will share. Beds are made by placing soft, warm quilts on the floor at night. At right, a city mother in Western clothes carries her baby on her back in the traditional way.

FESTIVALS BRING HAPPY TIMES FOR CHILDREN

At the left little boys are proudly carrying a miniature shrine in a procession during a religious festival. The Boys' Festival, or Iris Fete, comes on May 5. Parents of boys then hang paper carp on bamboo poles outside their homes, as shown at the right. On shelves inside are figurines of ancient knights and heroes whom the boy is taught to admire and imitate.

Since formal rules of etiquette govern much of Japanese behavior, boys and girls study and practice so they will make no embarrassing mistakes.

Children are honored at religious ceremonies and festivals. When a boy is seven days old his father bows before the household shrine and places on it a paper bearing the child's name. Thus he informs his ancestors that another member has been added to the family. Friends and relatives bring gifts for the boy at the name-giving ceremony.

When a boy baby is 32 days old and a girl baby is 33 days old, the child is taken to a Shinto shrine. There the priest records the name and birthday, and the child formally becomes a member of the community. The "first eating ceremony" takes place when an infant is four months of age. The mother sits with it at a tiny table holding a rice bowl and helps the baby pretend to eat with chopsticks. When the children reach the ages of three, five, and seven years they are taken to a shrine on November 15, while the parents give thanks that they have grown to those ages safely.

Festivals for Girls and Boys

Two of Japan's annual holidays honor the children. On March 3, the Dolls' Festival (or Peach Blossom Festival) reminds small girls that they must be as peaceful and gentle as peach blossoms. On rows of shelves draped in red, a favorite color for girls, are arranged ceremonial dolls that have been handed down from one generation to another. There are dolls representing the emperor and empress and court ladies and courtiers of ancient times. Most of the dolls are family treasures, but each little girl has two of her own. She takes them with her to her husband's household when she is married.

The Boys' Festival, May 5, is sometimes called the Feast of Flags or the Iris Fete. Every family with sons sets up a flagpole from which fly paper flags in the shape of the carp. As the boys watch the fish dart and twist in the air, they learn that their parents want them to be strong and brave like the carp, which struggles upstream past the waterfalls. Indoors they set up shelves bearing miniature figures of ancient warriors, tiny armor, and toy weapons.

Festivals for the Whole Family

The whole household celebrates the great holiday —New Years. According to the old way of calculating ages, this was everyone's birthday. Children were considered to be one year old at birth, and everyone

PEACH BLOSSOM FESTIVAL FOR GIRLS

Here we see the shelves of heirloom dolls displayed on the festival for little girls, March 3. The small hostess is learning formal etiquette as she serves her young caller.

added a year at the new year. On New Year's Day, the front entrances of the houses are decorated with pine trees and bamboo stems. Somewhere among the house decorations are fern leaves, an orange, and a small lobster. All these things have special meanings, and together they stand for good wishes for a long, strong, and prosperous life. Special foods and ceremonial drinks are served. Business acquaintances and personal friends call or leave their cards at the door, and greeting cards go by mail. People give presents to family and friends as Christians do at Christmas. Relatives gather for parties and everyone visits religious shrines and temples. People pay their debts and start new jobs, hoping for good luck during the new year.

Buddhists celebrate the Bon Festival in July. It has been compared with All Souls' Day. At this season spirits of dead ancestors are invited to return to their old homes and join their families at a feast. A dance ends the festival in the country districts.

Games and Sports of Children

Japanese children have a great deal of fun playing, just as youngsters do in every country. Even in a crowded city they find room for games in the garden of the neighborhood Buddhist shrine or in the schoolyard. Kite flying, battledore and shuttlecock, marbles, and hopscotch are favorite games. Small hands flash in *jan-kem-po*, known as "scissors and stones" in America. Traveling peep shows and professional storytellers draw eager audiences of children.

The youngsters love pets and beg to be told animal stories. In addition to such usual pets as dogs and cats, they may play with a pet chicken or keep crickets, grasshoppers, and katydids in small wire cages. The Japanese have always had many toys. Once they were ingeniously made by hand. Later they came to be manufactured by the millions in factories and widely exported. Most of them are fragile and made from cheap materials.

A FORMAL WEDDING

Here the bride's traditional costume contrasts oddly with the groom's Western clothes. This black kimono adorned with flowers and birds of symbolic meaning is one of three she wears. The veil over her elaborate hairdo is a "horn coverer." Jealousy is thought to vanish when it is removed.

As children grow older they take part in organized sports in the schools. A sports meet in October finds the best athletes competing and everyone shouting "Banzai" for their teams. Though they play Western games such as football, baseball, and basketball, many boys are loyal to the traditional sport of wrestling and work hard to perfect their skills in the difficult wrestling art of judo.

Children of poor families find little time to play. After school they must help in the fields or in home industries where they work side by side with their parents and other relatives.

The Wedding

When a boy reaches 21 to 23 years of age, his family begins looking about for a proper girl for him to marry. If friends recommend a young lady of suitable family background, the two are introduced. If neither strongly objects, his family selects a friendly go-between to carry on discussions with her parents and arrange the presents to be given by each side.

A supposedly lucky day is chosen as the wedding day. The bride's hair is elaborately dressed and covered with a silk cloth. She wears several different fine kimonos in the course of the festivities. Her family first entertains guests and relatives. Then the gifts are loaded on a wagon, and the group goes to the groom's home where the long, traditional ceremony takes place. The two are wed when the bride and groom sip *sake* (wine) three times from three cups in the presence of the go-between and his wife and the groom's father. At the banquet that follows, the bride serves a special fish to the guests. Dancing and gaiety follow the ceremonial activities. When all but her family have left, the bride brews them tea presented by the groom and sees them off at the gate. From then on she is part of the groom's family.

Marriage customs have been changed by some of the city folk in recent years. It has become fashionable to be married at a shrine and to hold the banquet in a restaurant. The more sophisticated young people sometimes choose their own mates instead of bowing to their parents' wishes.

Agriculture, Fisheries, Lumbering, and Mining

BY CULTIVATING every acre of land intensively, Japan's millions of farm workers manage to grow huge quantities of produce, but the country can supply less than 80 per cent of the food it needs. Rice is grown on more than half the total cropland—especially the readily irrigated alluvial lowlands. By their painstaking methods the farmers raise larger crops of rice per acre than any other farmers in Asia. From Tokyo southward the long growing season allows a second crop of some kind to be raised after the rice harvest. In the far south two crops of rice will mature. Elsewhere, vegetables,

FERTILIZING AND TRANSPLANTING CROPS IN JAPAN

No chore seems too unpleasant and slow for the Japanese farmer. The man at the left is dipping fluid human manure on each onion plant instead of wastefully broadcasting the fertilizer.

The hard work of transplanting rice, at the right, is required to get two crops a year from a field. Rice is sprouted in a seed bed before the winter crop in the paddy is harvested.

sweet potatoes, wheat, barley, rye, rapeseed, or clover may be planted in the fall. The farmers may also raise two or more crops on a field at one time. Where mulberry trees are cultivated to feed silkworms, crops such as vegetables, millet, buckwheat, or corn may grow between the trees. These are usually planted on higher land and on terraced hillsides. Soybeans may be sown on the slender dikes between the irrigated fields so that no square foot of land is wasted.

The chief industrial crops are mulberry trees, tea, tobacco, flax, hemp, and pyrethrum. These occupy only four to six per cent of the cultivated land. Tea is the national drink and plays an important role in Japanese life, but it utilizes less than one half of one per cent of the cropland. Fruits are widely raised —mandarin oranges in the south, and peaches, pears, apples, and other fruits of the temperate regions farther north.

Japanese farmers raise little stock. They generally use the few cattle as work animals rather than for milk or beef. Since their farming area is so limited they utilize it to grow human food directly instead of raising feed for stock. Pasture is poor, as the hills are overrun with wild, tough, coarse bamboo grass that cuts the mouths of cattle. Most farmers raise some poultry.

Farming in Cold Hokkaido

Farming conditions in Hokkaido differ from those in much of Japan. With a climate similar to that of New England, only one crop may be grown in a year. The leading food crops are beans, apples, white potatoes, sugar beets, cherries, hay, and oats. Flax, pyrethrum, and peppermint are the most important industrial crops.

This region was the last part of Japan to be settled. Most Japanese do not like its cold climate and do not understand how to farm the land. The government has promoted experiments in raising new crops and in dairying. United States experts aided in teaching new methods, and American-style dairy barns dot the landscape. The average farm contains about 11½ acres—about five times the average in the south.

Land for the Tenants

Despite their industry and skill, Japanese farmers find it difficult to make a living. At the end of World War II only a third of them owned land. The renters had to pay about 50 per cent of their rice to the landowners, and a poor yield left them with heavy debts carrying excessive interest. Under the Land Reform Law of 1946, initiated by the occupation forces, landlords were required to sell part of their land to the government. By 1952, the government reported that about 95 per cent of the farm families were landowners. The average holding is, of course, very small.

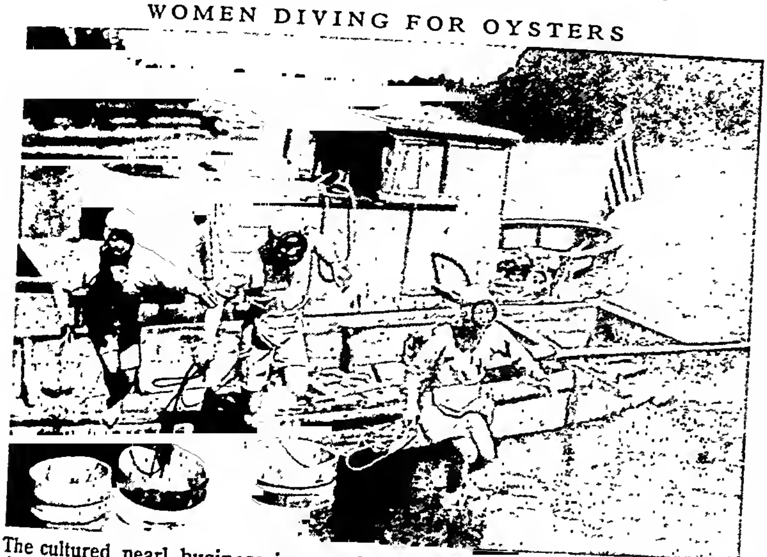
The problem of feeding the people grows more difficult each year. While the population is increasing steadily, tillable land is limited. The Ministry of Agriculture and Forestry is pushing a plan of land reconversion and improvement of irrigation, seed, fertilizer, and pest control. Bringing more land into production, however, requires enormous labor and expense in terracing slopes, draining coastal swamps, and fertilizing poor soil.

Fisheries Aid Food Supply and Exports

The fishing industry is a lifesaver in Japan. It employs 1.3 million people and supplies 85 per cent of all animal protein in the diet. Each person consumes an average of 60 pounds of fish a year, and fish exports are immense. The Japanese catch is greater in both tonnage and value than that of any other country in the world.

Fishing craft of every size ply the coastal waters and produce about three fifths of the total catch. In addition to their loads of sardines, herring, salmon, cuttlefish, yellowtail, and other varieties, the crews harvest seaweed for food, fertilizer, and fodder. The deep-sea fishing fleets go far out in the North Pacific for sardines, cod, bonito, shark, mackerel, and

WOMEN DIVING FOR OYSTERS



The cultured pearl business is a profitable part of Japan's great fishing industry. These diving girls bring up young oysters. A bead inserted within each shell is covered with lustrous nacre by the oyster, forming a pearl.

tuna. Huge floating canneries prepare crab and salmon for export. Whaling ships steam all the way to Antarctic waters.

Shellfish make up a valuable part of the output. An unusual phase of the oyster industry is the production of cultured pearls. A bead is inserted within the shell of a young oyster, which is placed in a shallow-water bed to grow. The oyster covers the bead with nacre in about seven years, making a beautiful pearl. These pearls are a valuable export.

Fuels, Minerals, and Timber for Industry

In minerals Japan is the poorest of the nations that have risen to world power in modern times. Energy resources, however, are favorable, and coal is the most important mineral. Though it is widely distributed in the country, two thirds of the output comes from Kyushu, where Nagasaki is the leading shipping port. The coal seams are often thin and broken. Mining is difficult. It is not highly mechanized and the output per worker is low. Little of the coal that is mined is suitable for making coke for blast furnaces, so coking coal must be imported. The few oil wells yield only a small fraction of the country's petroleum needs and there is little natural gas.

Lumbering is an important industry. Timber for construction and pulpwood for paper and rayon are produced in large quantities, though some importing is necessary. The forests supply wood and charcoal, the common domestic fuels, but the supply may become inadequate for future demand.

In all parts of Japan swift mountain streams, fed by the heavy rains, have been harnessed to make electricity for industry and home use. Even poor farmhouses usually have at least one or two lights. Few streams have reservoirs to store water, so power may be low in dry periods. Supplementary steam-power plants have been built near the industrial cities.

The earth yields less than 60 per cent of industry's mineral needs. Abundant sulfur serves as a base for the chemical, paper, and rayon industries and is available for export. Supplies of zinc, limestone, clay for tile and ceramics, gypsum, chromite, and arsenic are adequate, while enough copper, manganese, gold, and silver can be produced through costly mining operations. The deposits of low-grade iron can supply about one tenth of industry's needs, and the islands are lacking or low in aluminum, asbestos, lead, tin, nickel, potash, phosphate, and salt.

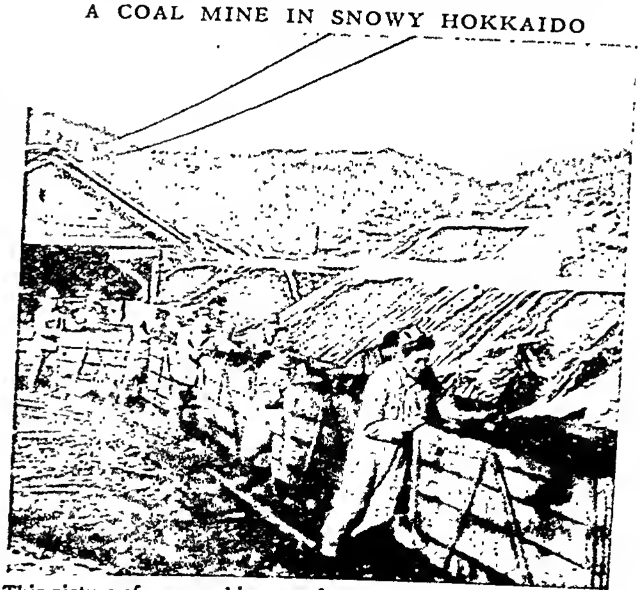
A Century of Industrial Growth

JAPAN is the leading industrial nation of Asia. It rose to first rank as a manufacturing country in amazingly few decades after its doors were opened to world trade, despite shortages in raw materials. Its alert industrial leaders bought factory machines from the West and copied or adapted Western methods. The government encouraged and subsidized their activities, helping them to grow in wealth and power. A belt of manufacturing cities spread from Tokyo around the Inland Sea to Nagasaki. Their factories received raw materials and shipped their products by cheap ocean freight through the convenient ports.

Workers were plentiful and they quickly acquired the new skills. They worked long hours—12 or more a day—for low wages, without the protection of labor laws. Women and girls made up a large share of the employees. Their wages were about half those of the ill-paid men. In family workshops, fathers, mothers, and children worked most of their waking hours.

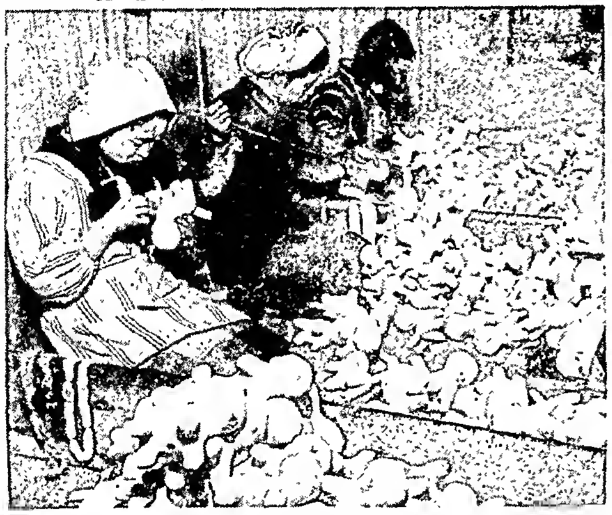
Until 1930 emphasis was on light industries where a cheap raw material could be changed by cheap labor into a product that would undersell those of competitors in world trade. The factories used Japanese raw materials—silk, kaolin and other pottery clays,

A COAL MINE IN SNOWY HOKKAIDO



This picture of men pushing cars from a coal mine shows the lag in mine mechanization. Although the output per man-hour is low, Japan's industrial life depends upon the coal mines.

A FAMILY TOY WORKSHOP AND A POTTERY FACTORY



These girls are stitching stuffed toy dogs in a family workshop. Toys such as these are made cheaply to flood the export market. Well over half of the factory laborers work in small shops.

These boys work in one of Japan's large dinnerware factories. They are touching up the decorations on plates. Notice that a conveyer belt brings the ware to the workers.

glass sands, lumber, and copper. They imported cotton, wool, iron and other ores, scrap iron, rubber, petroleum, and tobacco. Japan bought raw materials at low prices from the nonindustrial nations of Asia and sold them manufactured goods.

Textiles, especially cotton yarns and cloth, accounted for more than 30 per cent of the value of Japan's early output. Its cotton fabrics clothed its own and other Asian peoples and entered Western markets.

Silk was the leading export and the United States took 80 to 90 per cent of it. In the 1930's, though imported wood pulp was required, Japan became a leading rayon manufacturer, and silk exports fell off.

Among other important products were chemicals, cement, rubber goods, porcelain and earthenware, glassware, enameled ironware, preserved foods (especially canned fish), woodenware, hosiery, bicycles, toys, electric bulbs, and small articles for variety stores.

Heavy Industry on the Road to War

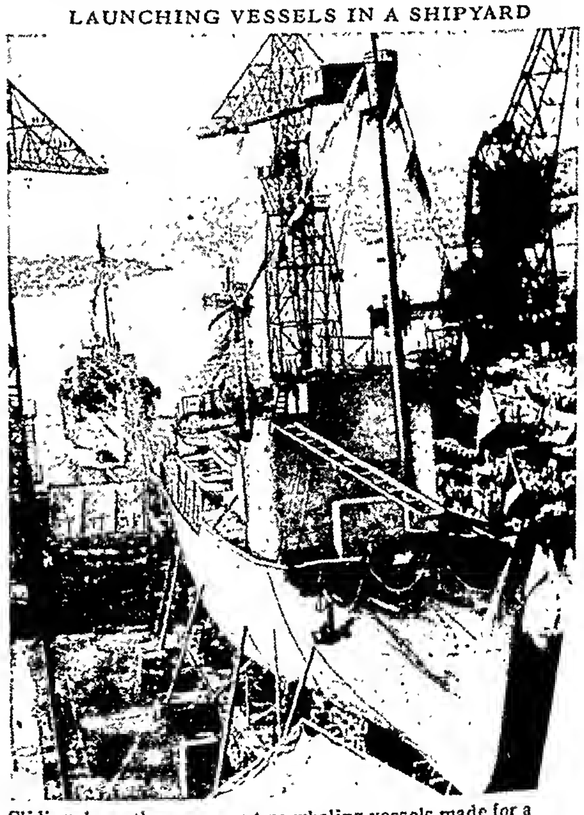
After 1930 the emphasis shifted to heavy industry as the militaristic government prepared for war. Iron and steel mills, refineries for aluminum and other metals, munitions plants, machine-tool and bearing factories, airplane and tank factories, and shipyards expanded, as did the imports of iron ore, coking coal, and bauxite.

The militarists invaded Manchuria to control and exploit its rich iron and coal mines. Heavy industries were developed there and in Korea.

The gigantic companies, called *zaibatsu*, that controlled the larger part of Japan's commerce and industry grew even richer. Most of the zaibatsu were family groups organized into holding companies with varied interests. The house of Mitsui, for instance, owned or controlled mines, lumber companies, ironworks, flour mills, chemical works, cotton, rayon, and paper mills, oil refineries, tea plantations, engineering and machine works, power plants, railroads, news-[illegible] department stores, insurance companies, banks, and steamship companies. Chief among the big houses were Mitsui, Mitsubishi, Sumitomo, Yasuda, and Okura. In no other modern industrial nation have so few persons controlled so much of the wealth.

Japan's entry into World War II was influenced by a desire to dominate neighboring lands and to take over their raw materials and markets. Their aims

LAUNCHING VESSELS IN A SHIPYARD



Sliding down the ways are two whaling vessels made for a [illegible]wegian firm. Shipbuilders have been busy since World W[illegible] replacing Japan's destroyed ships and filling foreign o[illegible]

A CAMERA FACTORY INSPECTION BENCH

These men are checking the assembly of fine cameras. Famous for their skill at precision manufacturing, the Japanese make and export cameras, optical instruments, and electric apparatus.

appeared to be succeeding as they overran sources of iron ore, petroleum, rubber, tin, and other vital materials in southeast Asia. As the Allies tightened their naval blockade, however, they shut off supplies of scrap iron, bauxite, oil, and other materials. In government drives for scrap iron, machinery was taken from textile and hosiery mills. Then the United States air forces pushed a systematic drive to smash the war industry. They blasted all the principal industrial cities except Kyoto, the temple city. Incendiary bombs burned thousands of household industries (*see* World War, Second).

At the end of the war, a large part of Japan's industrial plants lay in wreckage. Allied occupation policy called for the destruction of industry that could be used for rearming, but encouraged the development of other factories. The occupation government ordered the huge zaibatsu combines broken up and sold to employee-managers, new co-operatives, and other investors. It encouraged labor unions and recommended an eight-hour day and minimum wages for labor.

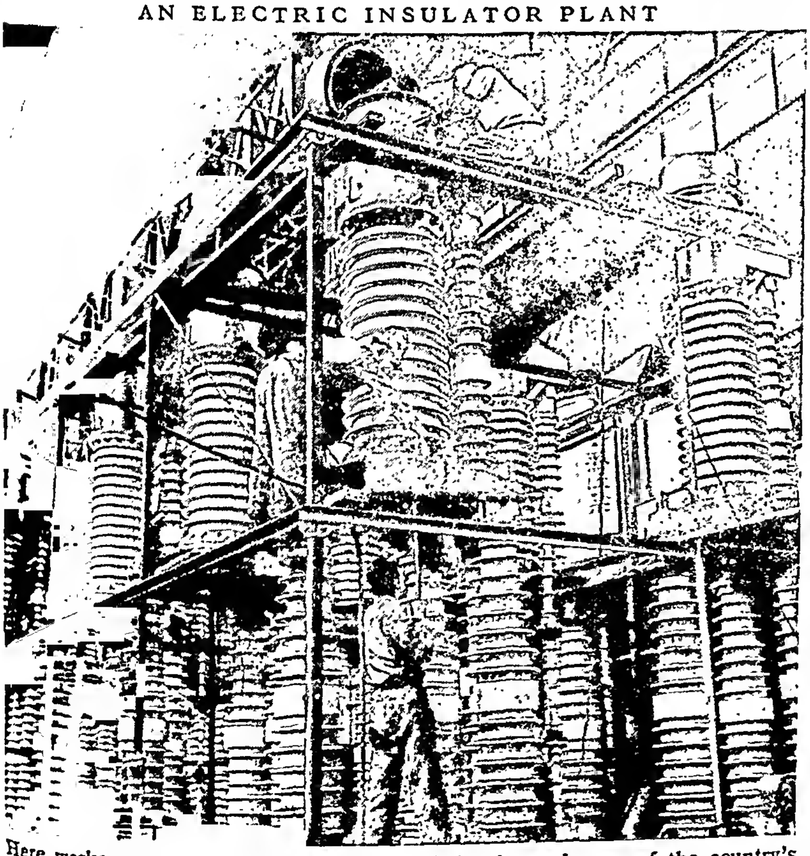
Postwar Recovery Efforts

The Japanese worked to rebuild and improve their plants and to revive international trade. They were aided by huge United States subsidies for the purchase of machinery and raw materials, food, and fertilizer. American contracts for more than 500 million dollars in war goods and services during the Korean war also spurred manufacturing, while spending by occupation troops supplied foreign exchange for purchases abroad. Reconstruction work in Korea opened another large market.

When Japan regained its sovereignty in 1952, some industries were producing at prewar levels, while others lagged badly. Imports remained many millions of dollars higher than exports, as purchases of food and raw materials were still high. The textile industry was again the leader in production and output for export. Its manufactures included cotton, silk, and artificial yarns and fabrics, with cotton fabrics ranking highest. The chemical industry turned out a huge volume of industrial chemicals and fertilizer. Production of iron, steel, and other metals approached prewar levels, and metal products were valuable exports. The machine industry was making equipment for Japanese plants and was exporting textile machines, sewing machines, rolling stock, electric machinery and appliances, bicycles, and optical instruments. Pottery and tableware were again selling well in world markets. Shipyards flourished—building vessels to replace Japanese shipping and fishing fleets destroyed in the war, as well as ships for foreign countries.

Japan faced severe obstacles in its drive for exports. Markets had changed since the 1930's. China, a logical market and source of coal and other raw materials, had become Communist and antagonistic toward Japan. Some lands of southeast Asia continued to resent their conquest

AN ELECTRIC INSULATOR PLANT



Here workers are putting together mammoth insulators in one of the country's leading heavy industries. The electric goods industry turns out machinery for the many hydroelectric power plants at home and for the export trade.

by Japan, and all were striving to build up their own industries—especially textiles. Inflation had raised Japanese production costs so they could no longer far undersell Western producers. New synthetics had destroyed the market for some Japanese products—notably silk for hosiery. Factory equipment and methods in such industries as rayon manufacturing were ten years behind those of the West.

In their drive to modernize and expand their plants Japanese industrialists sought assistance under United States government aid programs and from private industry. American firms sent experts to Japan and also trained Japanese engineers in their own home plants. In many cases they sold new equipment to Japanese firms and licensed them to produce patented items. In some instances they invested in Japanese companies. Japan, in turn, set up trade agreements with industrially backward Asian countries and gave them technical assistance.

Growth of the Cities

Japan's sweeping industrial development brought swift growth to its cities and metropolitan areas. Before industrialization the chief cities had grown as centers of religion or government. Tokyo, the former head of the shogun government, is the nation's capital, but its huge population was drawn mainly by industry and trade. It is the third largest city in the world. Kyoto, the old imperial capital and temple city, remains a producer of exquisite handiwork and art objects. Osaka, with its metal and textile plants, Nagoya, a textile and pottery city, and Kyoto all are well over a million in population. Twenty-four cities have more than 200,000 people.

The leading ports include Kobe, Yokohama, Osaka, Kure, Shimonoseki, Niigata, Aomori, Moji, Hakodate, and Muroran. Cities noted for heavy industry, such as Fukuoka and Nagasaki, lie on Kyushu near the coal fields. (*See also* articles on chief cities of Japan by name.)

Transportation and Communication

Water transportation has always been important in this island country. Heavy freight still moves from port to port along coastal waters and through the Inland Sea. The Japanese are the leading maritime people of the Orient. Before World War II they had the third largest merchant marine in the world. They carried their own goods in world trade and earned millions of dollars in foreign exchange as carriers for other countries. After the war, shipping companies took immediate steps to rebuild the fleets they lost in the war, and by 1952 they had reached 60 per cent of prewar tonnage.

Japan's first railroad was opened to traffic in 1872. The islands have a fairly close network of more than 15,000 miles of track today. Most of the mileage is government owned. The track is mainly narrow gauge.

AIR VIEW OF CENTRAL TOKYO

Here we look across downtown Tokyo toward the moat and wall of the Imperial Palace at upper left. This section was severely damaged by bombing in World War II. The railway station, at upper right, as well as many huge steel and brick office buildings and hotels, has been built since the peace. The circular building is the Nihon Theater on famous Ginza Street.

THE EMPEROR VISITS A POSTWAR SCHOOLROOM

This schoolroom on Shikoku Island has movable tables and chairs and modern world maps. It shows the influence of the American education mission brought to Japan by the occupation forces. Emperor Hirohito is at the left of the visitors at the back. An emperor's visit to a schoolroom was unknown in prewar times. He did not leave his palace except on state occasions.

A railway tunnel runs beneath Shimonoseki Strait, connecting Honshu and Kyushu, and a second tunnel, begun in 1939, is under construction there.

The modern nation's highway system is still based on the narrow, tree-bordered roads of old Japan. Over them people once rode on horseback, in rumbling oxcarts, or in palanquins carried by men. In the late 19th century, the jinrikisha, or ricksha, a light carriage drawn by swift runners, came into use. Today motorcars have crowded these vehicles from the city streets, but fewer than 10,000 miles of the roads are paved and suitable for motor travel. Air services link principal cities in Japan, while international airlines handle traffic with the rest of the world.

Highly Developed Communication

The telephone, telegraph, and postal services are operated by the government. Most of the 1½ million telephone subscribers are business firms. Radio and television programs are broadcast by privately and publicly owned stations. About six families in ten own radio receiving sets. The high cost of television sets limits their use in this low-income country.

Japan's more than 160 newspapers have a combined circulation of about 20 million—predominantly in the cities. During the war newspapers were censored. The 1946 constitution guaranteed freedom of the press. More than 2,000 magazines are published.

Postwar Education and Government

JAPAN'S PREWAR educational system, established in 1872, provided schooling from the primary grades through the university, but only the six-year primary school was free, compulsory, and coeducational. About 99 per cent of the children of school age attended, resulting in a high literacy rate of about 95 per cent for the country. Competitive examinations limited the number of pupils in schools of higher education. Boys who passed might advance to college preparatory work or technical courses. Few girls received advanced education. The girls' high schools offered homemaking courses, and women were not welcomed in the universities.

After the war the occupation authorities found that both the elementary and normal schools were highly militaristic and nationalistic in their teachings. They ordered revision of textbooks and curriculums to eliminate military and antiforeign instruction.

The new school system was organized under a law passed in 1947 at the suggestion of a mission of educators from the United States. It reflects American educational philosophy and school organization. Free and compulsory education is provided now to the age of 15. The child attends a six-year primary school and a three-year lower secondary school. Attendance at the three-year high school is optional.

University and college courses were extended to four years, and women were admitted to these institutions. The six main universities are Tokyo, Kyoto, Tohoku at Sendai, Kyushu at Fukuoka, Hokkaido at Sapporo, and Osaka. There are about a score more institutions of university rank. Since the war special efforts have been made to extend facilities for training scientists and technicians.

Government under the 1946 Constitution

Japan is governed under a postwar constitution approved by the Diet, Oct. 7, 1946. It retains the emperor as a "symbol of state and of the unity of the people" but gives him no governmental authority.

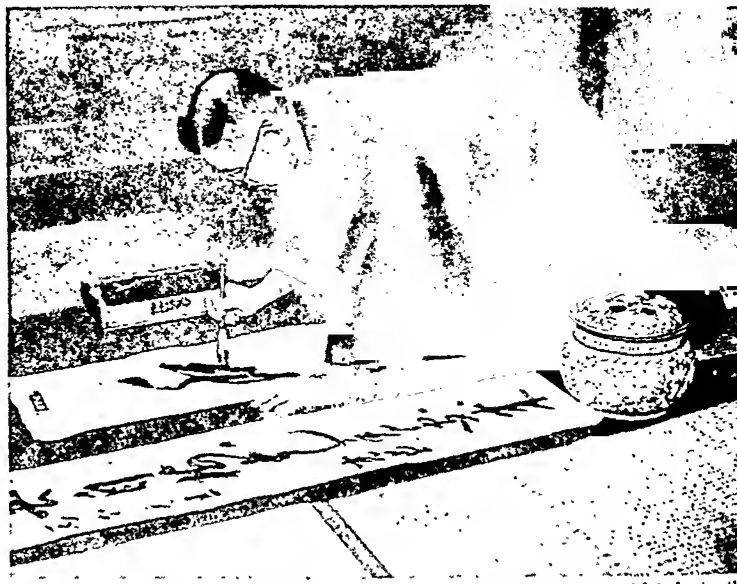
The Diet, a parliament of two houses, exercises legislative power. Members of both houses are elected by the voters. The lower body, the House of Representatives, controls the budget and must approve treaties with foreign powers. The upper, the House of Councillors, was created to replace the House of Peers. The constitution abolished the peerage.

The prime minister and his cabinet wield executive power. The prime minister is chosen by the Diet from among its own members, and he must be a civilian. He names his ministers and most of them must be members of the Diet. If the ministers lose the confidence of the Diet, they are asked to resign and a new cabinet is appointed. The prime minister may call for an election to learn the voters' will.

Judicial power resides in the supreme court and lower courts. The cabinet appoints the 15 judges of the high court. They must, however, be approved at the next election after their appointment. Each judge's appointment is reviewed by the voters every ten years.

The constitution provides for local government. Voters of cities, towns, villages, and prefectures elect their own officials and assembly members.

WRITING ON A SCROLL WITH A BRUSH



This man is writing with a brush, freehand, on a porous paper which instantly absorbs the India ink. The Japanese child is taught this skill early, and the training develops finger dexterity for other artistic work.

The constitution contains a bill of rights guaranteeing many of the same fundamental human rights that the United States Constitution does. The constitution abolished conscription, together with the army, navy, and air force. The nation pledged itself to renounce war forever. Women were given the vote under the constitution, and the voting age was reduced to 20 years.

Language, Literature, Arts, and Crafts

THE LANGUAGE of Japan is extremely difficult to read and write. Students must burden their memories to recognize hundreds of characters and must learn to write them clearly with brush and ink. The influence of Chinese culture long ago in the 4th century A.D. led to this complexity. The Japanese had no writing, so their scholars learned to read and write Chinese. Then people began trying to use the complex Chinese ideographs with the Japanese language. The characters did not fit well because the languages are so dissimilar.

Gradually the Japanese worked out abbreviations of the Chinese characters to stand for sounds, usually whole syllables, in Japanese words. The system, called *kana*, is thus a *syllabary* instead of an alphabet of single letters, as used by Western nations. Two different ways of abbreviating and writing these abbreviations developed. They were called *kata-kana* and *hira-gana*. Scholars also continued to use certain complete Chinese symbols to stand for whole words. In such cases they added *kana* to show pronunciation and even meanings. As a result of all these confusing developments, a man must learn about 100 Japanese kana characters and from 1,000 to 2,000 Chinese characters even to read the newspapers. A well-educated person knows several times that many Chinese symbols.

Literature in Ancient and Modern Times

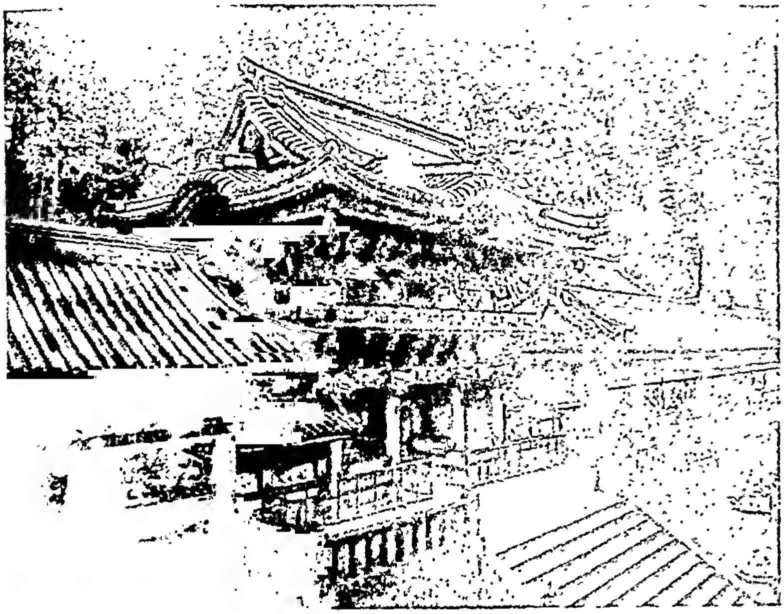
Writing difficulties hampered the development of literature in Japan. The early poems and stories were memorized and passed on by word of mouth. Chronicles of early history and mythology were finally published in the 8th century—one book in Chinese and another in Japanese using Chinese symbols. In the same period a giant collection of some 4,500 poems, the 'Manyoshu', appeared. They had been written by emperors and empresses, courtiers, and common folk in the course of the previous 400 years.

Many poems in the 'Manyoshu' were written in the *tanka* form. This is an unrhymed poem of 31 syllables, arranged in five lines of 5, 7, 5, 7, 7 syllables respectively. Later a shorter form, the *hokku*, was developed. It omits the last two lines. Japan's great poets have produced miniature gems of expression in these forms. Poetry writing in Japan, however, is not confined to specialists. Anyone may try his hand at composing these simple verses.

The novel in the Japanese language strangely enough had its start among the court ladies of the 11th century. While male scholars clung to the Chinese language, the women began writing in their own language and symbols. The best known of these early narratives was 'The Tales of Genji' by Lady Murasaki Shikibu, a classic still admired at home and in foreign translation. Historical fiction became popular in feudal times as authors recounted the lives of famous rulers and warriors. Diaries too were a popular literary form. The 17th and 18th centuries witnessed a revival of poetry and the creation of new types of prose literature. The best-known popular romantic novelist was Takizawa Bakin (1767–1848).

After the beginning of foreign commerce in the late 19th century, Western classics were extensively translated and published in Japan. English poetry and novels were especially widely read and they influenced Japanese literature. French and Russian influences led to naturalist and proletarian movements in literature. During World War II strict

GATEWAYS TO TWO ANCIENT SHINTO SHRINES



Yomeimon (Gate of Sunlight), the entrance to Toshogu Shrine, in Nikko, is registered as a National Treasure. It dates from the 16th century. One of the most beautiful in Japan, it is elaborately carved, painted, and gilded.

The great camphorwood torii, gateway to Itsukushima Shrine, rises out of the Inland Sea off the shore of Miyajima Island, southwest of Hiroshima. At the right is one of many stone lanterns which decorate the shrine.

censorship halted the flow of literature and many literary magazines failed or were suppressed. When freedom of the press was restored in 1945 many novels appeared dealing with moral degeneration after the surrender. Japanese literary groups offer a number of prizes to encourage young writers.

The Drama in Japan

The Japanese created unique forms of drama. The classical *no* drama developed in the 14th century from ancient dances under the patronage of the powerful shogun Yoshimitsu and other noblemen. Its performance resembles that of a solemn opera and consists of music and dancing accompanied by recitation. The chief actors wear masks. Stage scenery is scanty and symbolic rather than realistic. Today the no drama is kept alive through performances given by schools, supported by aristocratic enthusiasts. (*See also* Dance, subhead "Japanese Dance Drama.")

The no drama was too solemn for the common people, so the *kabuki* drama was created in the 17th and 18th centuries to please the tastes of the prosperous merchants in the cities. Plots and acting were more realistic than in the no drama. The kabuki theater remains popular today. Revolving stages and elaborate settings and costumes afford a spectacular background for the charm of the actors. From 1629 to the late 19th century, actresses were not permitted to take part in performances, and men played women's roles.

Puppet plays, originally imported from China, were in high favor in the 16th and 17th centuries. The puppets were smoothly manipulated to the music of the samisen and the chanting of dramatic ballads.

In the last century Western plays and musicals have grown in popularity, as have Japanese dramas in the Western style. Motion pictures have been produced since 1913. About 70 per cent of the motion-picture houses show Japanese films almost exclusively, while 30 per cent exhibit foreign films, predominantly American.

Popularity of Occidental Music

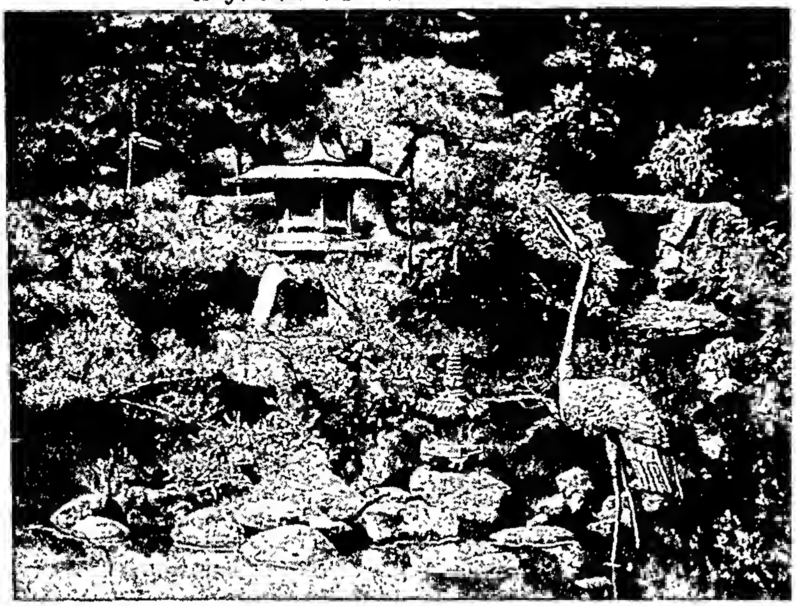
The Japanese people have enthusiastically adopted Western music. The great cities have symphony orchestras and opera companies. American jazz and popular music have reached even the smallest hamlets through the radio. The schools offer classes in music and music appreciation. Most modern Japanese composers follow the Western style.

The music of old Japan lingers mainly in the classical theater and dance and in the peasant festivals. Most of the traditional musical instruments were brought from China, Korea, and India through the centuries. The most popular, the samisen, is an instrument with three strings. It was first brought to Japan on trading vessels from the Ryukyu Islands.

Chinese and Buddhist Influence in Art

Earlier Oriental civilizations, especially China's, influenced and stimulated the growth of Japanese arts and crafts. Japanese artists, however, did not slavishly copy the imported forms. Instead they stamped their work with their individuality to develop art forms recognized as typically Japanese. The painstaking skill of Japanese handcraftmen has turned many useful wares into collectors' items, valued for their graceful symbolic design and exquisite detail.

A JAPANESE HILL GARDEN



This typical garden contains dwarf trees, a pond, a hill, stone lanterns, bronze cranes, and a bridge. The gardener has created a composition in landscape much as an artist would compose a scene on canvas.

The Buddhist religion, brought to Japan by Korean missionaries in the 6th century A.D., influenced every field of Japanese art. Since Buddhism had originated in India, it carried Indian, Persian, and even Grecian and Roman influences.

Architecture in Temple, Shrine, and Palace

Ancient Buddhist temples, designed according to the Chinese temple plan, are still standing. Set on rock foundations the temples may have walls of lattice filled with plaster or no walls at all. The pagoda, a tower with each story marked by a gently flaring roof, is extensively used. Roofs are constructed from red, dark green, or gray tile, often ornamented at the edges and supported by bracketed pillars. Masterpieces of the painter's and sculptor's arts decorate the Buddhist temples.

Shinto shrines were at first extremely simple wooden structures standing amidst beautiful groves. Their ornamental gateways, called *torii* (meaning "bird nest"), are shaped like the Greek letter *pi* (π) and consist of two posts surmounted by beams with upturned ends. When the Shinto religion was made an instrument of the state, its shrines became elaborate. They are embellished with carved designs, bright with red lacquer and gold.

Domestic architecture, both in small home and in palace, is severely plain. Feudal lords built great castles on lofty rock cliffs, with barred windows and tile or plaster walls. Copper dragons guarded the cornices, and the interiors were lavishly decorated with paintings and lacquer. Japanese architects have a strong feeling for the beauty of natural wood and seldom use paint or even varnish in a house. The art of landscape gardening contributes much to the beauty of the palace and the small home alike. It is an ancient art, following traditional formulas. The minor art of flower arrangement has been brought to perfection by the Japanese.

Statues in Wood and Bronze

Since stone is scarce in Japan, sculptors turned to wood and bronze in creating the statues for Buddhist temples. The museums of Nara and Kyoto contain exquisite wooden images dating from the 6th and 7th centuries. At the end of the 16th century a new style of temple decoration called for carvings colored in gold and vermilion, the favorite Buddhist colors.

The wood carver's skill is also seen in small figurines, such as the *netsuke*, designed to fasten the cord on a gentleman's sash or tobacco pouch. The faces of these human or animal images have amazing expressiveness.

Of the many fine bronze statues, the most famous is the colossal Daibutsu, or Great Buddha, at Kamakura. Formed of sheets of bronze, cast separately and finished with a chisel, it rises 42 feet 6 inches in height. The face is more than 7 feet long, with eyes 3 feet 5 inches wide. In ancient times the metalworker devoted himself to images and temple adornments and to armor and weapons for warriors. Today he makes vases, bowls, and lanterns for commercial purposes.

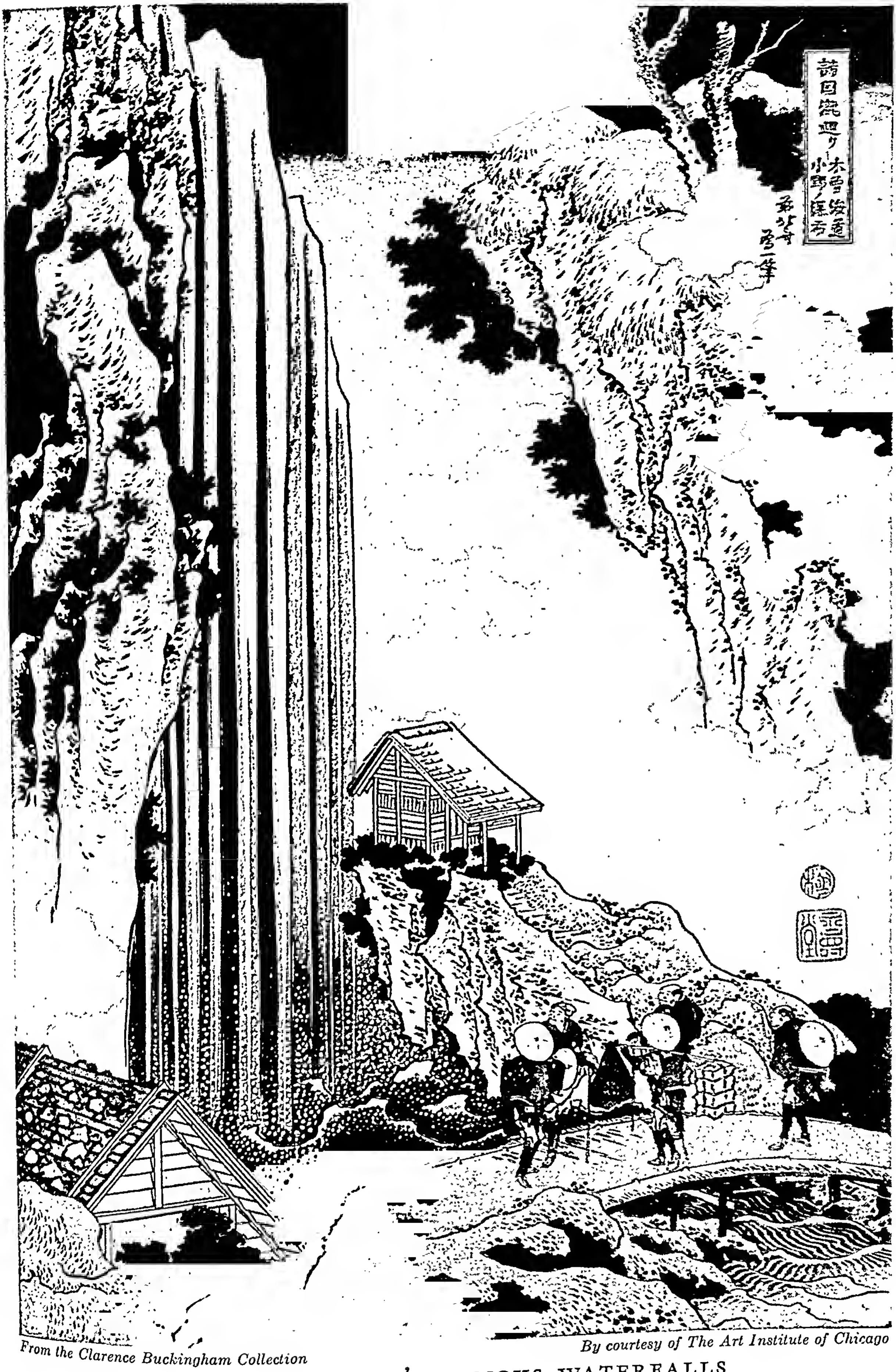
Unique Qualities of Japanese Painting

Japanese painting has great delicacy, charm, and imaginative quality. The artist seeks to master the few bold strokes that represent a river or a wave and the straight lines that depict rain, blades of grass, or shoots of bamboo. He makes no attempt to portray an entire scene but selects significant or symbolic elements. Pictures appear flat because modeling, to give the appearance of relief, is not attempted and nature's shadows are not shown. The lack of perspective contributes to the flatness. India ink is used for the bold black lines, and water colors are mixed with rice paste or fish glue. Color is applied on absorbent paper or on closely woven silk.

ONE OF HOKUSAI'S FAMOUS WATERFALLS

Hokusai Katsushuka (1760–1849) is one of the foremost of the artists who made Japan's color prints famous. He and Hiroshige led in landscape pictures. The print opposite is one of a series of eight he made of waterfalls. So modern in spirit and technique is his work that it is more highly regarded in Western countries than among the more conservative Japanese. Notice his straight, almost geometric, treatment of the falling water and his originality in handling perspective in the pine-crested cliff beyond the chasm.

The colors used in printing from his wood blocks were all made from vegetable dyes. When exposed for years in frames, these have often faded, so that many collectors think his original colors were subdued. This picture, reproduced from a print that has never been long out of its original wrappings, shows a bold, incisive use of color values.



From the Clarence Buckingham Collection *By courtesy of The Art Institute of Chicago*

ONE OF HOKUSAI'S FAMOUS WATERFALLS

From the Clarence Buckingham Collection *By courtesy of The Art Institute of Chicago*

JAPANESE PRINT OF THE 18TH CENTURY

Painting developed under the patronage of religion, of the imperial house, and of the wealthy nobility. Early Buddhist frescoes were stately in style and portrayed celestial scenes. Paintings in the middle ages were usually commissioned by the ruling lords to decorate the screens, sliding wall panels, and scrolls in their palaces.

One school of painters, the *Yamato-e*, took the ceremonial, social, and military life of the nobility as their theme. Painted in bright colors and with firm lines, the small, detailed figures of knights and ladies and prancing battle steeds are full of life and movement. A second school, Chinese in inspiration, had as its leader a Zen Buddhist priest, Sesshu (1420–1506). These men painted delicate animals, flowers, and birds with a few strong strokes of the brush, often on a gold background.

After the powerful shogun Tokugawa made Yedo (now Tokyo) his capital in the 17th century, the prospering city folk demanded paintings illustrating the life of the people, and the *Ukiyo-e* school sprang up, specializing in genre paintings.

The Popular Art of Color Printing

Artists of this school brought the art of color printing from wood blocks to a state of perfection in the 18th and 19th centuries. The talents of painter, wood carver, and printer all contributed to the excellence of the prints. The wood carver pasted the artist's painting on a wood block and transferred the design to the block by carving away the wood between the lines. He made a separate block for each of the subtle gradations of color in the print. Then the printer inked each block and pressed it against the paper in careful register. Since hundreds of copies were made from a set of blocks, the prints were cheap. They were sold separately and also used as book illustrations. For the first time the common people could own works of art.

The best known of the many color-print artists include Shunsho, Sharaku, and Toyokuni, noted for portraits of actors; Harunobu, Kiyonaga, Eishi, Utamaro, and Toyokuni, for pictures of beautiful women; and Hokusai and Hiroshige, for landscapes. Color printing is the Japanese art most familiar to and admired in Europe and America. The prints influenced Western artists, especially the French impressionists. Western painting in turn influenced the Japanese. Many paint in the Occidental style.

THE DAIBUTSU, OR GREAT BUDDHA, OF KAMAKURA

This is the most famous statue of Buddha in the world. Its colossal size (42½ feet high) and the intellectual power and serenity of its beautiful face are tremendously impressive. Made of bronze, it was cast about 1350.

JAPANESE PRINT OF THE 18TH CENTURY

Famous for his color prints of beautiful women, Hosoda Eishi (1746–1829) created the portrait of Ujiyama, a noted Japanese beauty of the 18th century, reproduced on the opposite page. His work is remarkable for the refinement of his drawing and for his success in handling subtle color combinations. Each shade of color necessitated the cutting and exact registration of a separate wood block.

Ujiyama is posed to represent the poet Kisen Hoshi. She is seated at a low desk of red lacquer and is holding a writing brush. On the table (from right to left) lie a book, a decorative poetry-writing card, an inkstone used for grinding ink, a small pot holding water to mix the ink, and a box covered with a silk cloth. On it is a bronze brush holder in the form of a dragon. On the floor stand a manuscript box and a bronze candlestick with a floating wick.

Fine Work of Craftsmen

The Japanese make no sharp distinction between artist and artisan. Their craftsmen bring to their tasks the love of beauty, sensitive taste, and exceptional manual skill of the fine artist. For centuries they have been famed for their work in pottery, cloisonné, damascene, ivory carving, bronze and brass, lacquering, and the weaving of fine silk fabrics. Many of the crafts came first from China, but Japanese artisans added distinctive designs and improved the processes in many cases. (*See also* Enameling; Pottery; Lacquer and Shellac; China, section "Architecture, Painting, and Other Arts.")

Today the Japanese use mass-production methods in turning out many of the wares for which the hand-

workers first gained fame. Though the goods are not as beautiful as the hand-wrought pieces, they find a wide market in world trade.

Japan's Long History

Mythology and legend are so intermingled in Japan's early history that it is difficult to separate fact from fiction. The legends say that the empire goes back to 660 B.C., when the first emperor, Jimmu Tenno, a descendant of the sun-goddess Amaterasu, came to the throne. According to these traditions, the 124th in this imperial line was Hirohito, emperor during World War II.

Historic research, however, indicates that the early Japanese, who had migrated from Asia, first lived in scattered clans, or family groups. About the 4th century A.D., the imperial family gained control over a number of other clans and set up the first actual state. Its center was a small plain, called Yamato, east of the Inland Sea.

With the spread of Buddhism from China in the 6th century this primitive nation was exposed to the brilliant ancient Chinese culture. For the next few centuries, during its T'ang Dynasty, China was the mightiest and richest land in the world. Missionaries brought its learning and arts to Japan, and the Yamato government sent young scholars and artists to China.

The Japanese absorbed this advanced culture in a remarkably short time. They patterned their small state after the Chinese government system. The rulers built their first capital, Nara, and the later capital, Kyoto, on the Chinese city plan (*see* Kyoto).

As the court grew more luxurious and the emperor and nobles turned to scholarly and artistic pursuits, power slipped from their hands. During the 10th and 11th centuries, the Fujiwara family actually controlled the government, though the emperor retained his hereditary position. In the outlying provinces the warrior lords, called *daimyo*, and their knights or soldiers, known as *samurai*, extended their power. In 1192, one of the lords, Minamoto Yoritomo, emerged supreme in the civil wars and became the real ruler. He appointed military officials in all the provinces and took the title *sei-i-tai-shogun*, or "great barbarian-subduing general." His village, Kamakura, became the true capital. Here a new literature, drama, and art developed to suit the robust tastes of the warrior lords.

ANCIENT HANDCRAFTS OF KYOTO

Silk weaving dates back to the founding of Kyoto in 794 and the demands of the imperial court for the finest fabrics. This weaver is working with a hand loom. The pattern which he is following stands before him at his left.

High-grade lacquer ware has been made in Kyoto for more than a thousand years. The city is especially known for gold- and silver-lacquer work; that is, ware with designs produced by means of gold or silver dust mixed with lacquer.

The Shogunate and Feudalism

The office of shogun, thus begun, continued for nearly 700 years. Until the late 19th century the shogun was much more important in Japanese affairs than the emperor. Though the emperor at Kyoto was theoretically the ruler, he reigned but did not govern.

Most of the land came to be held by the military lords in great tax-exempt estates, and a system of feudalism, much like that of medieval Europe, developed (*see* Feudalism). The daimyo and samurai were widely separated from the commercial and agricultural classes. They lived according to a code called *bushido* (the way of the warrior), similar in many respects to the code of chivalry among Europe's knights.

Defeat of Mongols and Arrival of Europeans

Constant civil warfare resulted from the struggle among the warriors for leadership. In the 13th cen-

PORCELAIN AND CLOISONNE WARE

Japan produces handmade porcelain of the finest craftsmanship. Kutani ware has been made in Kanazawa since the middle of the 17th century. This potter is cutting the base of a Kutani bowl from the rest of the clay with a string.

The making of cloisonné ware is a very ancient art. Like porcelain, cloisonné is made by handcraftmen, who learn the art from their fathers and pass it on to their sons. The small factories employ only four or five workers.

tury, however, the rival factions joined to hold off attempted invasions by Mongol fleets sent by the great Kublai Khan. The armadas were destroyed by a typhoon, called a *kamikaze*, or divine wind.

The first Occidentals reached the Japanese islands in the 16th century. Europeans had read of the rich islands of Cipango in Marco Polo's book about his travels in China (*see* Polo, Marco). Columbus and other explorers had sought the islands in vain (*see* Columbus). The first to see the country were two Portuguese sailors whose ship was wrecked there in 1542. The great missionary Saint Francis Xavier began his labors among the Japanese in 1549 (*see* Xavier). The Dutch, English, and Spanish soon began a flourishing trade, and for a time both trade and Christianity were encouraged.

Early in the 17th century the shoguns began to close Japan's doors against Europe. They placed Christianity under a strict ban. The Japanese, who had sent trading missions as far away as Mexico, were forbidden to leave the country on pain of death. Trade with European nations was cut off, except with the Dutch, who were permitted to send a few ships each year to Nagasaki. The chief reason for the policy of exclusion probably was a fear that Christianity might pave the way for invasion.

During the next two centuries the nation prospered and a sense of national unity developed. The strong shoguns of the Tokugawa family put an end to civil war. Crafts and trade flourished. Though merchants ranked low in the feudal social system, certain trading families made huge fortunes. Western science and technology had become known to students who read Dutch books. Despite backward feudal government, the country was ripe for a change when Commodore Perry arrived in 1853.

Beginnings of the New Japan

Commodore Perry and his fleet had been sent by the president of the United States to persuade the Japanese to stop mistreating sailors from wrecked American whaling vessels and to get a treaty allowing ships in the China trade to enter Japanese ports. The treaty, signed the next year, opened two ports to American trade. Within a few years ports were opened to other Western countries. The treaties gave Western nations extraterritorial rights in Japan and permitted customs duties to be fixed by treaty. This meant that Japan surrendered the right to fix its own tariffs. These conditions were objectionable to the Japanese; after a struggle of some 40 years they were removed.

A period of confusion followed the opening of the country to foreign trade. A few nobles from the country districts continued to demand that the foreigners be ejected, while the merchants of the port cities saw the advantages in foreign intercourse. Political leaders came to recognize that feudalism and the shogunate were outmoded institutions. When an able emperor Mutsuhito, or Meiji (ruled 1867–1912), came to the throne, the shogun abdicated (1868). Japan's transformation to a modern capitalistic nation and a world power was well started in his reign. Feudalism was abolished. Peasants might now own land, and the new army became a national army recruited from every class. Daimyo and samurai received compen-

sation for the loss of their privileges and many entered business as opportunities arose.

Much of the land soon fell to large owners. The farm workers, compelled to pay high rents and taxes, became poorer. Industry, trade, and finance came to be almost monopolized by a few extremely wealthy concerns, the zaibatsu. Industrial workers were exploited.

In his "charter oath," Meiji urged his people to seek knowledge and wisdom in all parts of the world so they could help strengthen the empire. Embassies of statesmen and students set forth to visit and study the achievements of the West. They were garbed in the dress of old Japan, in kimonos with plaited overskirts of heavy silk. They wore their hair in queues knotted on top of their heads. In appearance they were men of the old Japan, but their minds were alert for new ideas.

A New Constitution and Government

German political institutions impressed those who were appointed to study governments. They drafted a constitution (promulgated by the emperor in 1889) on the German pattern. It provided for a cabinet, headed by a prime minister, a privy council, and a Diet of two houses. The upper house of peers was made up of the new nobility. The lower house of representatives was elected by males over 25 years of age, who paid a tax of 15 yen or more. These voters were only one per cent of the population. From a group of influential samurai who had helped reorganize the government was formed the *Genro* (or Elder Statesmen), which wielded great influence in national affairs.

The German army and British navy were selected as models for military reorganization. France and Italy contributed conceptions of art and architecture. The United States and England provided ideas on education and industry.

How Expansionist Policy Arose

Japan's rapid rise to a place among the great powers amazed the world. Economic and political reasons lay behind the policy of aggression through which the nation for a time dominated the Pacific. Population pressure was great in this rugged island empire. Immigration barriers prevented emigration in large numbers to Australia or America (*see* Immigration). Regions open to Japanese settlers, such as Manchuria, did not attract them because of their cold climates and low standards of living. Raw materials and markets were needed for the new light industries. The leaders saw in Manchuria, Mongolia, and north China undeveloped land where resources could be exploited.

The Japanese saw how European powers were carving out colonies and spheres of influence in weak lands. They feared that a strong and hostile nation might establish itself in Asia. Militaristic leaders decided that it was their destiny to rule eastern Asia. They began to create the armed strength to realize this aim.

Building an Empire

Japan first moved to strengthen its strategic position in the neighboring peninsula of Korea, a vassal state of China. In a successful war against China in 1894–95, the new army and navy forced China to recognize Korea as independent and to cede to Japan Formosa and the Pescadores Islands. Japan also obtained the Liaotung Peninsula in Manchuria; but Russia, Germany, and France compelled the Japanese to return it. Then within two years these three nations acquired leases on territory in China.

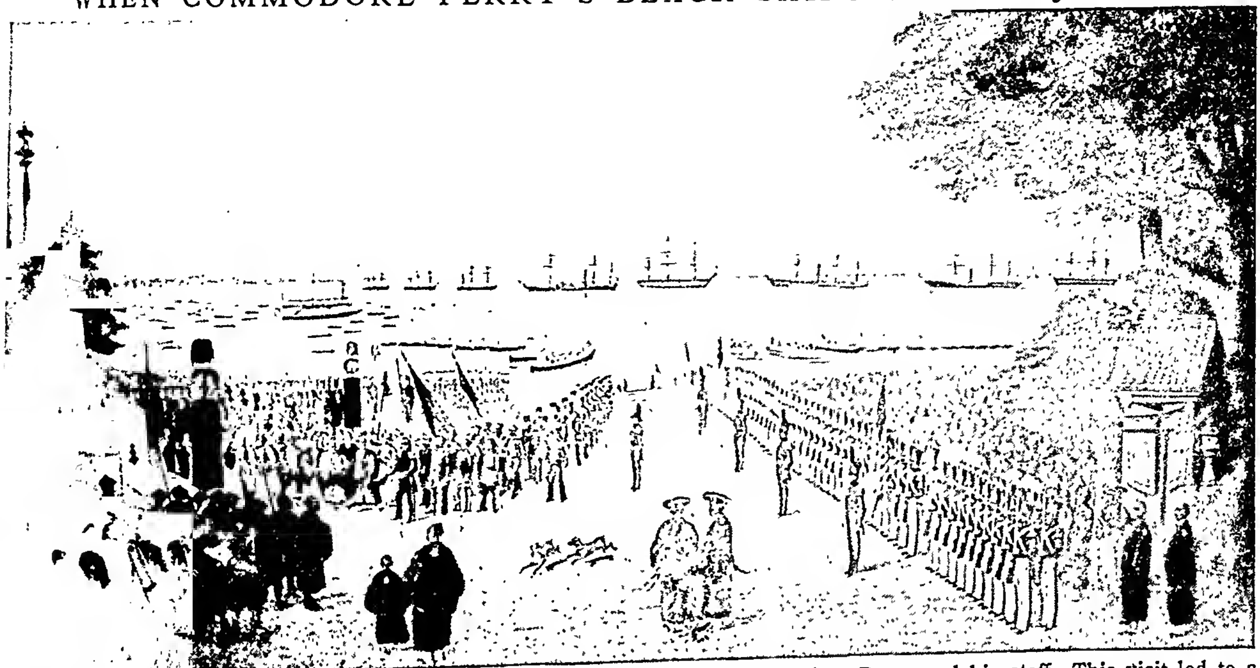
Japan considered Russia a rival in China and a menace to its own security, for the Russians were obtaining a foothold in Manchuria and threatening Korea. The inevitable war, in 1904–5, brought victory

FEUDAL SWORDMAKING AND ARCHERY

Here an actor representing a feudal swordmaker is tempering the curved blade of iron for which Japan was famous throughout medieval Asia. Notice the religious symbols over the forge.

Clad in the costume of the feudal knights, who originated the sport, this archer shoots a target while riding full speed, reloads, and shoots again and again over a 370-yard course.

WHEN COMMODORE PERRY'S BLACK SHIPS VISITED JAPAN



This old print pictures the beginning of a momentous era in Japanese history. A flotilla of American ships is lying in Yokohama harbor on March 8, 1854. Japanese high officials are greeting Commodore Perry and his staff. This visit led to a treaty permitting the opening of trade with the nation, which had been a "hermit," excluding foreigners for two centuries.

to Japan. With this victory came recognition as one of the world powers. Russia was forced to give to Japan its rights in Manchuria, including the Leased Territory of Kwantung on the Liaotung Peninsula and half the island of Sakhalin, and to recognize Japan's superior interest in Korea (*see* Russo-Japanese War). Five years later Japan annexed Korea.

Gains from World War I

The first World War offered Japan an opportunity to strengthen its position. In 1914, in accordance with a treaty of alliance with Great Britain, it seized the German possessions and special interests in the Far East. Under the Versailles Treaty it received a mandate over former German islands in the north Pacific and retained Kiaochow and German possessions in Shantung Province. These rights were renounced in 1922 under pressure from the Great Powers.

In 1915 Japan had taken advantage of the war to coerce China into accepting its "Twenty-One Demands," which would have made China a virtual colony. The most drastic demands were withdrawn under protests from the United States; but Japan gained concessions in east Mongolia and a share of control over south Manchuria. At the Washington Conference in 1922, Japan signed the Nine-Power Treaty, agreeing to maintain the "open door" in China and guaranteeing its territorial integrity.

As Japan grew stronger the militarists and extreme nationalists strengthened their hold on the nation. The government became a military dictatorship. It subsidized armament manufacturing and levied crushing taxes. The Diet passed a "thought control" law in 1925, authorizing the imprisonment of Japanese even suspected of criticizing the government. The people were imbued with expansionist ideals through the schools, the controlled press, the state religion, and army indoctrination.

Invasion of Manchuria and China

The aggression that developed into a war for mastery of the Pacific began in 1931. Japan conquered Manchuria and set up the puppet state of Manchukuo (*see* Manchuria). China, the Western Powers, and the League of Nations protested to no avail. Japan resigned from the League and in 1934 proclaimed itself "guardian of the peace of the Pacific." Then the militarists pushed into north China on various pretexts. This aroused Chinese resentment and stiffened their resistance. Fearing that China had a secret treaty with Russia, Japan made a pact with Germany.

In July 1937 militarists provoked a new "incident" near Peking and took "positive action." The Western nations condemned Japan for treaty violation and protested its bombing civilians and endangering the lives of foreigners. In 1940 a puppet government was set up in Nanking to rule north and central China.

Japan Enters World War II

The second World War seemed to be the militarists' great opportunity. While the Nazi military machine was crushing Europe in the second year of the war, Japan signed a "new order" alliance with Germany and Italy. The treaty recognized Japan's dominance of "greater East Asia." Japan also won concessions from defeated France in Indo-China. The next year found the Nazi army deep inside Russia, Japan's old enemy. Japan's military leaders then launched their forces at the Western democracies in a gamble for quick victory and rich resources. They had come to believe their own propaganda—that the democracies, especially the United States, were too corrupted by luxury and enfeebled by pacifism to fight a long war.

Without warning, on Dec. 7 and 8, 1941, Japan invaded Thailand, bombed Hawaii, the Philippines, and other American outposts, and attacked British possessions in the Far East. The Americans, British, and Dutch were not prepared to defend their distant territories. The United States fleet was badly crippled at Pearl Harbor. The Japanese overran the Philippines, the Netherlands Indies, Malaya, and Burma. In the southern Pacific they menaced Australia; in the north they seized outposts in the Aleutians. The Japanese empire then dominated more than 500 million people and 4 million square miles of territory, including rich sources of rubber, tin, petroleum, and other vital raw materials. Japan began incorporating the area into a grandiose "Greater East Asia Co-Prosperity Sphere," but it had little time to exploit its gains. (*See* World War, Second; Pacific Ocean.)

The Tide Turns

The defeat of Japan began when its navy lost the battles of the Coral Sea and Midway in 1942. Its fleet was forced to retreat before the expanding United States Navy and became ineffective by late 1944. Its land forces continued to fight savagely to hold every island in its chain of defenses. One position after another was destroyed, however, as the United States built up its forces along the far-flung fronts. Japan's air force was overcome by America's air might, though suicide fliers (named kamikaze in tribute to the "divine wind") wreaked heavy damage on American ships. By 1945 American bombers flying from aircraft carriers and conquered islands were wrecking Japan's factories and military installations.

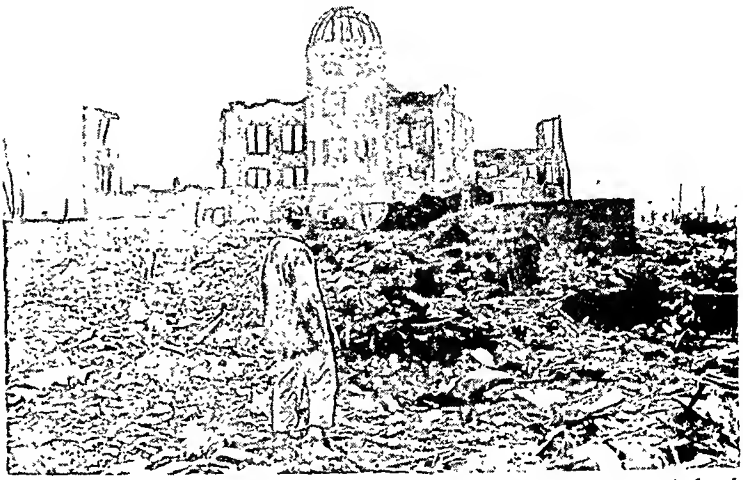
The terrifying destruction wrought by atomic bombs at Hiroshima on August 6 and at Nagasaki on August 9, together with Russia's entry into the war on August 8, allowed Japan's political leaders to admit that the war was lost. On August 14 they accepted the Allies' Potsdam Declaration. This meant unconditional surrender, the return of all territory conquered since 1895, and restriction of the country to the four home islands. On September 2, Japan's representatives surrendered to Gen. Douglas MacArthur, supreme Allied commander, on the battleship *Missouri* in Tokyo Bay.

American troops occupied Japan, except for a small area in Honshu taken over by British Commonwealth troops. The 11-power Far Eastern Commission determined occupation policies; but the United States directed Allied control. General MacArthur exercised supreme authority, with the advice of an Allied Council. The emperor and the Diet remained in office acting under the advice of the Supreme Commander for the Allied Powers (SCAP). Emperor Hirohito had personally announced the surrender.

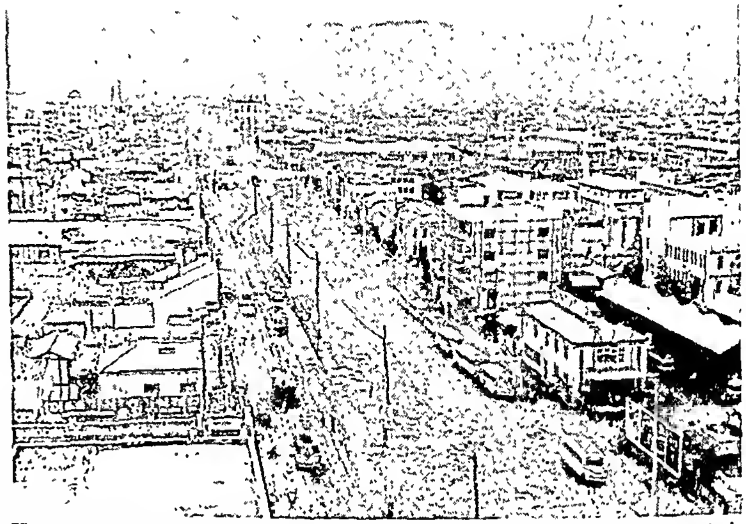
Achievements During the Occupation

Japanese military forces were demobilized and their arms destroyed. The Allies planned reparations, but could not agree on each country's share. In 1946 military and civilian war criminals were brought to trial. The trials ended in 1948, and 25 major war criminals were found guilty. The wartime premier, Hideki Tojo, and six others lost their appeal to the United States Supreme Court and were executed. A political "house cleaning" resulted in the removal of thousands of militaristic officeholders, and they were prohibited from participating in politics.

HIROSHIMA IN 1945 AND IN 1953



This is the "atomic desert" that resulted when the world's first atomic bomb fell on Hiroshima. While most of the city was reduced to rubble or fragments, part of the Industry Promotion Hall withstood the tremendous explosion.



Here we see the results of eight years of effort by the citizens to rebuild their homes and business structures. In the left background the ruins of the Industry Promotion Hall stand as a grim reminder.

LAND OF HIS OWN AT LAST

At the right stands 75-year-old Shozo Otsuka, the first tenant-farmer to buy land under the Land Reform Program of 1946. His grandson, at left, tills the field he may one day inherit.

The aim of the occupation was political, economic, and social reform rather than punishment. Most of the Japanese people, disillusioned with their military leadership, offered unexpected co-operation and sought eagerly to understand and practice democracy.

As part of their reform efforts, the occupation authorities set about liquidating the family trusts. They had textbooks rewritten to eliminate the doctrines of militarism and worship of the emperor. They forged ahead with a program of dividing large estates among tenant farmers. Labor unions were encouraged.

After Constitution Day, May 3, 1947, Japan was governed under its new constitution enacted with the influence of SCAP. In 1949 MacArthur announced that the basic aims of the occupation had been achieved and he began relaxing occupation controls. Reparation payments were eased.

Japanese respect for MacArthur amounted almost to reverence. The people were amazed when he was removed from office, April 11, 1951, due to a disagreement with President Truman over the conduct of hostilities in Korea (*see* MacArthur). The occupation policies established under MacArthur were continued by his successor, Gen. Matthew Ridgway.

After the Peace Treaty

On Sept. 8, 1951, the United States led 47 Allied nations in signing a peace treaty with Japan. Russia refused, and China was not represented. The treaty confined Japan to the four home islands and nearby small islands. Japan formally renounced claims to conquered areas in the old empire. Instead of reparations in money or goods, Japan was to repay in services by processing raw materials for war-damaged nations. A separate bilateral security pact with the United States provided for the retention of American military bases and defense troops. Japan regained full sovereignty on April 28, 1952.

As the Japanese regained control of their affairs world observers watched to see whether occupation reforms would be permanent. Wartime leaders, previously "purged," resumed political activity. Segments of the big holding companies consolidated to increase their economic power as the Japanese drove strongly for greater foreign trade.

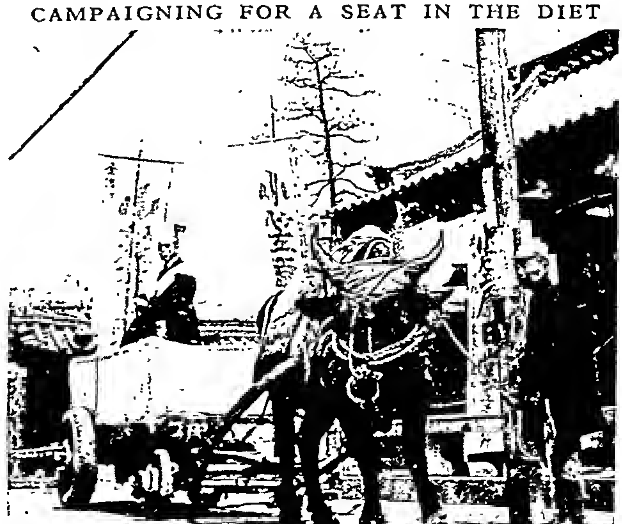
The right-wing Liberal party held almost uninterrupted control of the government. Communists in the Diet dropped from 20 in the first election to none in 1952. For the most part both the government and the people were pro-American, but there were some conflicts and dissatisfactions. There were objections to the continued presence of American forces and, at the same time, opposition to the American State Department's suggestion that Japan's 110,000-man National Safety Force be increased to 350,000 to defend the country. The people hoped to remain neutral in the conflict between democracy and Communism, though their country would be in the forefront if an East-West war broke out.

Economic problems continued to harass the Japanese. Though they had made amazing progress in rebuilding their war-torn factories and certain industries had reached prewar production levels, imports remained from 750 million to one billion dollars above exports. American aid, money spent by occupation forces, and war goods and services for the Korean action helped fill the gap for many years, but the problem of finding wider markets remained crucial.

Though inflation continued, workers remained poorly paid according to Western standards. Unemployment in the cities threw a heavier load on the already overburdened farms as the jobless returned to their families in the rural areas.

In March 1954 Japan and the United States signed a new mutual defense pact. Under it America was to supply wheat, munitions, ships, and planes, while Japan was to increase its defense force to 160,000 men, with a view to the eventual withdrawal of American forces from the country.

CAMPAIGNING FOR A SEAT IN THE DIET



Here a Buddhist priest is speaking from an oxcart on a Kyoto street. He is campaigning for a seat in the House of Councilors, the upper house of the Diet.

REFERENCE-OUTLINE FOR STUDY OF JAPAN

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BIBLIOGRAPHY FOR JAPAN

Books for Younger Readers

Buck, Pearl. The Big Wave (Day, 1948).

Coatsworth, E. J. Cat Who Went to Heaven (Macmillan, 1948).

Edelman, Lily. Japan in Story and Pictures (Harcourt, 1953).

Iwamatsu, Jun. Village Tree (Viking, 1953).

Japanese Children's Stories from Silver Bells (Periodical) (Tuttle, 1953).

Mears, Helen. First Book of Japan (Watts, 1953).

Vaughan, J. B. Land and People of Japan (Lippincott, 1952).

Books for Advanced Students and Teachers

Battistini, L. H. Japan and America from Earliest Times to the Present (Day, 1954).

Benedict, Ruth. Chrysanthemum and the Sword (Houghton, 1946).

Clifton, A. S. Time of Fallen Blossoms (Knopf, 1951).

Gray, E. J. Windows for the Crown Prince (Lippincott, 1952).

Hersey, John. Hiroshima (Knopf, 1946).

James, D. H. Rise and Fall of the Japanese Empire (Macmillan, 1951).

Latourette, K. S. History of Japan (Macmillan, 1947).

Matsuoka, Yoko. Daughter of the Pacific (Harper, 1952).

Mishima, Sumie. The Broader Way, a Woman's Life in the New Japan (Day, 1953).

Reischauer, E. O. Japan, Past and Present (Knopf, 1953).

Sansom, G. B. Japan in World History (Inst. of Pacific Relations, 1951).

The WORLD'S RICHEST *Tropical* ISLAND—JAVA

Extent.—East-west, Cape Sedsno to Java Head, 635 miles; north-south, 117 miles. Area: Java, 48,504 square miles; Madoera, 1,725 square miles. Population (1930 census): Java, 39,-755,902; Madoera, 1,962,462; (1950 est.) Java and Madoera, 52,000,000.

Climate.—Monsoon climate; mean temperature at sea level 79° F., varying about two degrees in a year; annual precipitation, 70 to 250 inches; dry season, especially marked in eastern half of Java, May to September.

Administrative Areas.—Provinces: West Java, Central Java, and East Java (including Madoera). Original native states: Djokjakarta Sultanate, Soerakarta or Solo Sultanate, and Preanger regencies (absorbed by Indonesia).

Cities (1950 est.)—Jakarta, formerly Batavia (capital, Republic of Indonesia, 2,800,000); Soerabaja (800,000); Bandoeng (750,000); Soerakarta (500,000); Djokjakarta (500,000); Malang (500,000); Semerang (307,000); Bogor (Buitenzorg) (124,000). Following cities, 1930 census: Pekalongan, Koedoes, Cheribon, Magelang (100,000 to 50,000); Kediri, Tegal, Madioen, Probolinggo, Pasoeroean, Soekaboemi, Poerwokerto, Tjilatjap, Blitar, Grisee, Tasikmalaja, and Banjoewangi (50,000 to 25,000).

Products.—Sugar, rice, corn, cassava, sweet potatoes, peanuts, soybeans, copra, tea, coffee, tobacco, rubber, quinine, palm oil, kapok, agave, teakwood; petroleum and its products; textiles, tires, cigarettes.

Boatmen ply one of the many canals that thread old sections of Jakarta, largest city of Java. These Javanese canals provide cheap transport, but they are mosquito breeders, and most white people live in drained suburbs.

JAVA. Few places show such striking contrasts as Java, the richest island in the East Indies and the heart of the sovereign Republic of Indonesia. First, Java is near the Equator, and heavy rains tend to clothe much of it with tropical forests as dense as those of the Amazon or the Congo. In such regions the people are usually few as well as indolent and backward. But Java has a larger population than any other region of comparable size. For every square mile it has about 900 people. Though it is smaller than the state of New York, it has about as many people as all the Atlantic states from Maine through South Carolina. And these people are industrious and healthy. So neat and well kept are the towns and the plantations that travelers call Java a "tropical Holland."

A YOUTH OF JAVA

The high collar is "official dress" and shows that this lad is a clerk or an official.

Second, the native population has an ancient civilization, little changed by long contact with Europeans. Food, dress, and customs are much the same as they were centuries ago. Yet much of Java's wealth comes from meeting the world's most modern needs—needs for commodities such as petroleum and rubber.

For more than three centuries, from 1611 to 1949, this great, rich island belonged to the little Kingdom of the Netherlands, on the other side of the world. Despite the tiny size of the Netherlands, it had little trouble with its huge colony until after the second World War. The Dutch regime, a model of colonial administration, had given Java a relatively liberal government and encouraged social equality. The Dutch intermarried with the Javanese.

Mountains, Volcanoes, and Valleys

The long, narrow island may be thought of as a ridge of mountains with low coastal plains. It extends about 600 miles from east to west, and most of it is from 40 to 50 miles wide. The ridge is capped with volcanoes, some active and some extinct, and it is broken across by some ten valleys.

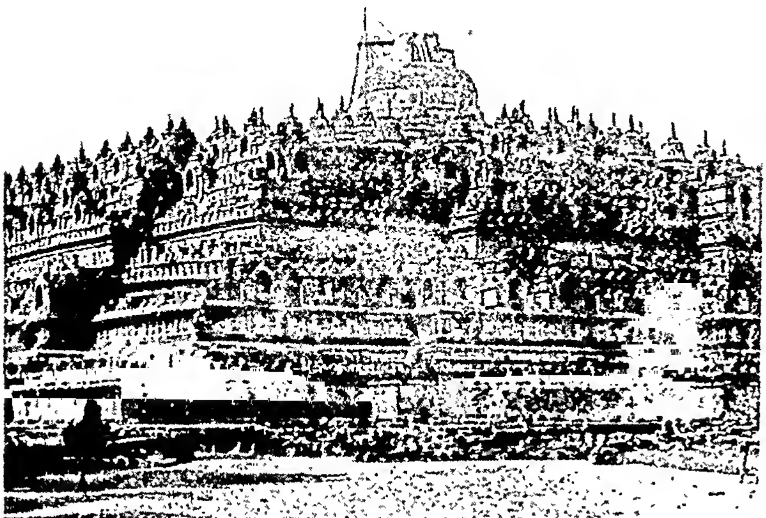
Because of this central ridge, each side of Java has a wet and a dry season, but at different times. (The reason is explained in the article East Indies.) Thus for part of the year the people enjoy some relief from steaming equatorial heat, but frequent equatorial showers even in the dry season maintain a rich plant life the year around. The high ridge also gives a change from a tropical climate at sea level to a climate with seasonal frosts near the summits. This temperature range permits a wide variety of crops to be grown.

The volcanoes contributed to Java's riches by laying a cover of ash over the island. This ash makes the finest of soil, and constant wash by rains has spread the soil flat in the valleys and on the coastal plains, thus making cultivation easy.

Strange and Familiar Plants and Animals

As a result of this moist, warm climate and of the variation in altitude, Java has an exceptionally rich and varied plant life. For a third of a mile above sea level, the plant growth is tropical, with palms, figs, jasmine, bamboo, acacia, and vines of the rattan palm and of peppers. Above this is a subtropical level, with magnolias, orchids, and ferns. Nearly a mile above sea level, on the central ridge, the forests

THREE MILES OF SCULPTURE AT BORO BUDUR



This is the central portion of the great Buddhist *stupa*, or temple, at Boro Budur. It was built in the 8th century. The structure is a series of terraces built around the hill. Three miles of reliefs portraying the life of Buddha line the terraces.

begin to resemble those of the United States, with oak, chestnut, and maple. Here one sees azaleas, rhododendrons, raspberries, and blackberries.

Some 20 peaks rise above 10,000 feet; the highest is Mount Semeroe (12,060 feet). On their higher slopes frosts occur and cool-climate plants grow, such as ironwood, myrtle, elder, barberry, and the Javanese edelweiss. In the drier eastern region there is savanna instead of forest, with trees along the rivers. This is the teak-tree region.

Most of the animals are forest-dwelling types. Among the many birds are weaverbirds, parrots, ducks, and peacocks. One kind of swift makes a gluey nest which the Chinese prize for soup. There are huge, gaily colored insects, and some of the spiders are large enough to catch birds. Among the reptiles are pythons, cobras, crocodiles, and lizards. One of the lizards is so large that it attacks poultry.

The most dangerous mammals are the tiger, the one-horned rhinoceros, and the leopard. Other large animals are the banteng (a wild ox), wild pigs, and deer, including the muntjac and musk deer. Smaller animals include apes, squirrels and flying squirrels, rats, hares, and the scaly anteater. Fish and shellfish abound in the sea and the rivers, and are an important part of the food supply. The Chinese raise fish on the rice fields between crops.

"Estate" and "Native" Agriculture

Nearly two-thirds of the land is cultivated. Only one-twentieth is in European plantations or "estates." These estates employ only about one-tenth of the native farmers, but they grow most of Java's wealth, because they produce crops for export.

The plantations in the hot lowlands grow rubber, cotton, sugar cane, coconuts, and tobacco. On the subtropical uplands they grow tea, quinine, and coffee. Java supplies nearly all the world's natural quinine, but the coffee industry has suffered from Brazilian competition. Only two of the major exports, cassava and kapok, are largely grown by natives on their own land, but these are important because they make up most of the world's supply.

The native farmers provide most of the food. Nearly half of the cultivated land is irrigated and planted to rice. Other food crops are sweet potatoes, beans, cassava, and, on the subtropical uplands, corn. Sheep, goats, poultry, and humped cattle are important food animals. The water buffalo is the chief work animal. But despite the marvelously fertile soil and government farm aid, the food supply is short and rice must be imported.

Industry and Transportation

To provide work for some of the teeming mass of natives, the Dutch government did much to encourage the growth of industry. Most of the plants are owned by Europeans or other aliens; natives serve as workmen. The chief industries are those that process Java's petroleum,

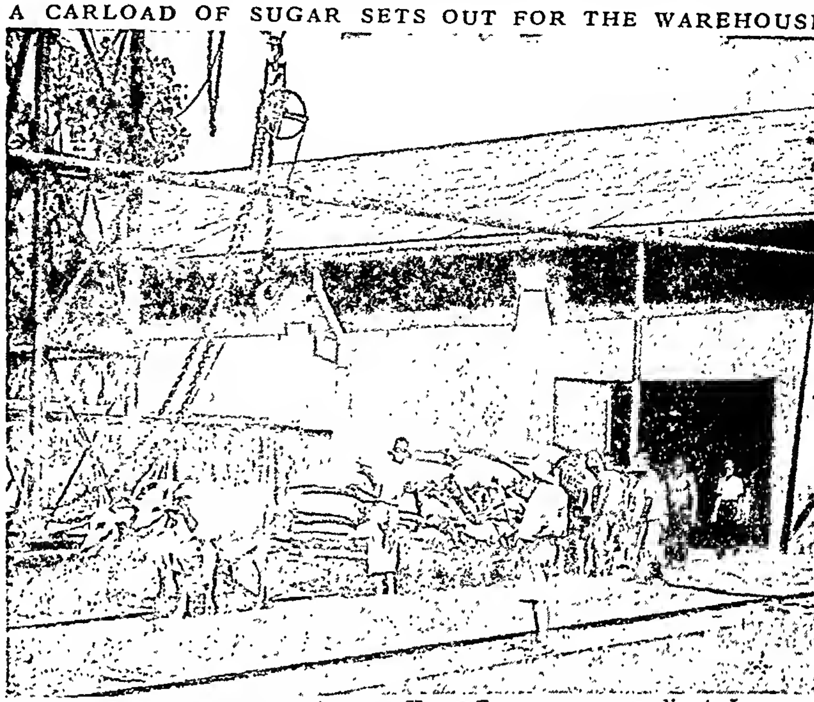
FOREST SETTING FOR A VILLAGE

This scene can be matched almost anywhere in central and western Java. Trees grow riotously, except where land is cleared for crops.

rubber latex, tobacco, and other export products. "Native industries" make pottery, parasols, hats, rattan ware, textiles, and leather goods. Oil wells and refineries are located in the north-central part of Java.

The ports are connected by coastal steamers, and the island is laced with some 3,000 miles of railroads and tramways, largely state owned, and 17,000 miles of roads.

A CARLOAD OF SUGAR SETS OUT FOR THE WAREHOUSE



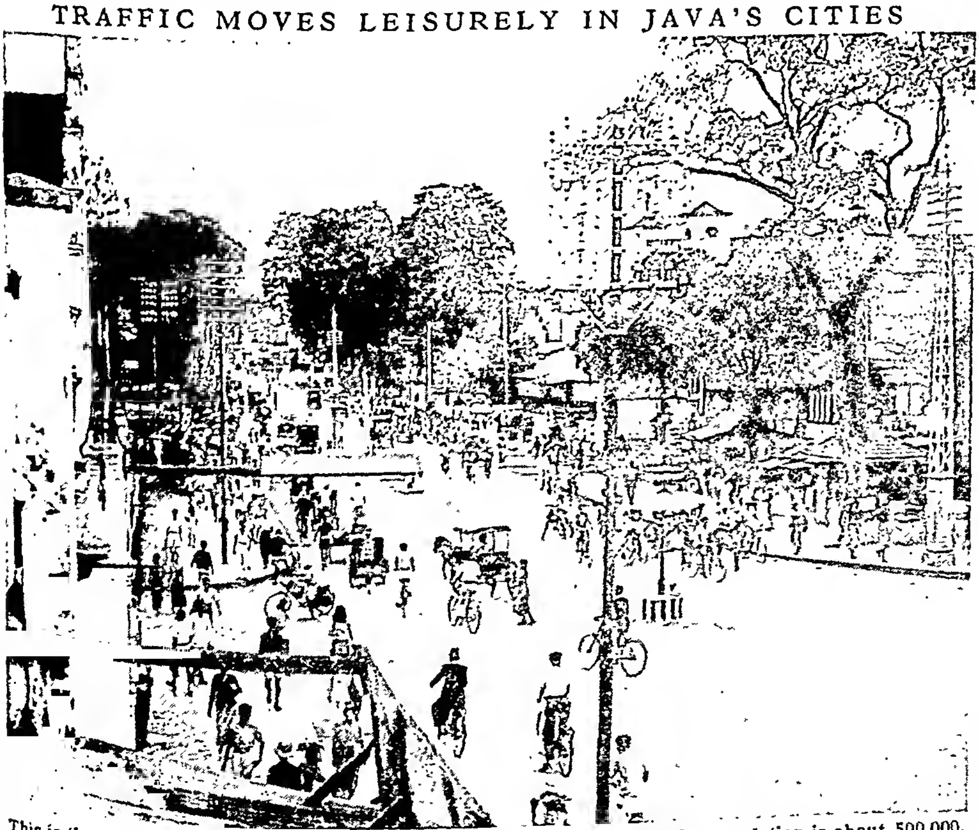
In Java's lowlands sugar is a major crop. Here a European overseer directs Javanese workmen loading a flatcar of sacked sugar. The zebus, or humped oxen, will haul the load to port for shipment. Zebus are common draft animals in tropical Java.

The Cities of Java

Despite its huge population, Java has only a few large cities. Only about one-twentieth of the natives live in cities or towns. The largest city of the East Indies is Jakarta, near the western end of Java. It is the capital of the Republic of Indonesia. The city's port is Tandjong Priok, about five miles distant. When the Netherlands ruled Java, Jakarta was called Batavia, which was founded by the Dutch in 1619.

The second largest city is Soerabaja (Surabaya), near the eastern end. The Dutch developed it as their chief naval base and sugar-exporting port. Other ports are Semarang, Cheribon, and Tjilatjap (Chilachap). The largest inland city is Bandoeng (Bandung). An elevation of 2,346 feet gives it a comfortable climate, and so Dutch officials established there many governmental offices and schools. Between Jakarta and Bandoeng is Buitenzorg, noted for its botanical gardens. Other major cities include Djokjakarta, Soerakarta, and Malang.

TRAFFIC MOVES LEISURELY IN JAVA'S CITIES



This is the bazaar center of Djokjakarta, one of Java's few large cities. Its population is about 500,000. Notice the towering electric light posts and the many bicycles. At the right, a traffic policeman stands on a striped platform under an umbrella.

Dutch Aided Java

Before the struggle for independence shook Java in 1946, the Dutch colonial government had made remarkable progress in improving the conditions of the people (*see* East Indies). Health measures reached practically all, and housing was improved. Education was slowly lowering the high degree of illiteracy, and natives were being trained as administrators.

The natives have developed and preserved a rich art. Their elaborate temples, ritual dances, and shadow plays are akin to those of India, and are famed for their imaginative

symbolism and technical achievements. Their metal ware is ornate and skillfully worked, and their batik is one of the world's notable textiles.

Malayan Heritage Dominates

Although most of the people are of Malay strain, their past has produced a division into Sundanese in the west and Javanese in the east. The Sundanese are almost pure Malay, with light skins. They often have oblique Mongolian eyes. The Javanese are darker and show many traits of physique, language, and character inherited from the Hindus that long ruled the land. Hindu rule lasted from early in the Christian Era until Mohammedan Malays overthrew the Hindus about 1478, and destroyed their culture not long before the first Portuguese traders reached the island.

The Hindus developed the highest civilization in all the East Indies. Many of their immense temples still stand. The most imposing one, at Boro Budur, was built between 750 and 850. Boro Budur was Buddhistic, as were most of the others; but some temples served Brahmanistic gods. (For further history of Java, *see* Indonesia.)

Chinese, who make up about $1\frac{1}{2}$ per cent of the population, conduct much of the storekeeping, small business, and the more exacting types of agriculture. Many of them, unlike their countrymen elsewhere, have forgotten their ancestral language. The whites are only a thin group of teachers, plantation owners, businessmen, and professional men. They amount to less than one per cent of the population.

Neighbor Island of Madoera

Separated from Java by a mile-wide strait is the island of Madoera. It is mostly a mud flat, with plant and animal life like that of eastern Java. The chief industry is obtaining salt from springs and sea water. It has some petroleum. The native Madurese live largely by fishing and cattle raising. The principal cities are Pamekasan and Bangkalan.

JAY, JOHN (1745–1829). Like Washington, John Jay was a man "pursued by public office." For a quarter century after the start of the Revolution, he was given diplomatic missions, appointed to some important offices, and elected to others. In two instances he was chosen for prominent offices while abroad on the nation's business.

Jay could render this public service freely because he came of a wealthy New York family. His ancestors were Huguenots who improved their position steadily; his father was a well-to-do merchant. Jay was born in New York City Dec. 12, 1745. He was serious-minded and studious even as a boy. In 1764 he was graduated from King's College (now Columbia University) and four years later he was admitted to the bar. His ability and confidence, together with his family connections and social standing, soon made him one of the most respected lawyers in the colonies. In 1774 he married Sarah Livingston. They had two sons and five daughters.

JOHN JAY

Jay never sought public office, but his fellow citizens kept him serving his country for 25 years.

When the Revolution started, Jay's fellow New Yorkers, knowing his abilities, made him a member of the New York Committee of correspondence, the Continental Congress, and the New York Provincial Congress. At first Jay feared that the Revolution would bring mob rule, but he supported it wholeheartedly once the Declaration of Independence was adopted. He helped draft a new constitution for New York and served as the state chief justice until 1779. Then he served as president of the Continental Congress until that body sent him to Spain to obtain endorsement of American independence and a loan.

The mission was hopeless, because Spain was a colonial power and did not care to encourage revolts. In 1782 he was sent to France to help Benjamin Franklin (and later John Adams) negotiate a treaty of peace with Great Britain. When the peace was signed, Jay declined appointments as minister to Britain or France, hoping to return to private life. Upon reaching home, however, in 1784 he found that Congress had named him secretary of foreign affairs.

Service to the New Nation

He served until a new government was formed under the Constitution, and he was named first chief justice of the Supreme Court. But this service was interrupted in 1794 when he was sent to England to settle many outstanding questions left from the Revolution. The resulting agreement, known as Jay's Treaty, provided that the British would withdraw from the forts they still held in the Northwest Territory by June 1, 1796. The United States agreed to pay certain debts contracted by its citizens before the Revolution. Commissions were provided to settle disputed parts of the boundary between the United States and Canada.

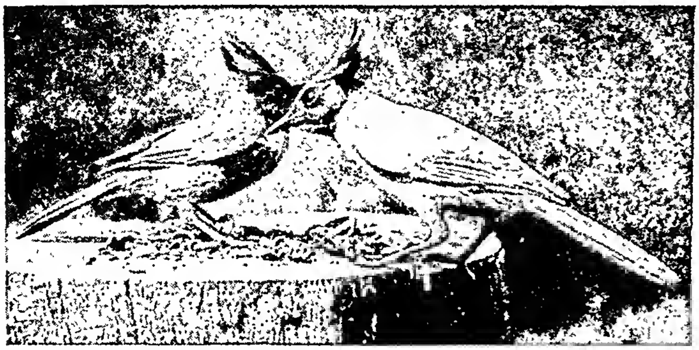
Jefferson and his fellow Democratic-Republicans assailed Jay and Washington's administration bitterly for failing to secure Britain's promise to cease interfering with American ships at sea; but the Senate ratified the treaty. Jay himself escaped much of the controversy, for in his absence he had been elected governor of New York. He served two terms, then at last was free to resume private life. He lived in retirement on an 800-acre estate near Bedford, N. Y., interesting himself in church affairs, and serving as president of Bible societies. He died May 17, 1829.

The blue jay of the eastern states (top) is noisy and quarrelsome, but it is one of the handsomest birds. The California jay (bottom), known locally as the "blue squawker," lives along the Pacific coast. It does not have a crest. It is very similar in appearance to the Florida, or scrub, jay, which is confined to the coasts of Florida.

JAY. Noisy and impudent, the jays attract attention wherever they live. They are robbers and bullies, with a bad reputation for destroying the eggs and young of other birds. They even steal the partly finished nests of their neighbors and complete them to suit their own taste. But it is hard to dislike jays. They are handsome birds, and they have an engaging curiosity about human beings.

The jays are relatives of the crows, ravens, and magpies. With these, they form the family *Corvidae*. Jays are found throughout the world, except in New Zealand. Most of them are forest dwellers, but the

STELLER'S JAY OF THE WESTERN MOUNTAINS



The long-crested Steller's jay is purplish-blue barred with black. It lives in the western mountain forests. The crest is lowered in flight.

familiar blue jay of the Eastern and Middle Western states and Canada, nests in city trees. Jays feed on fruits, seeds, insects, and refuse. Through most of their range they are year-round residents. They migrate locally and for short distances.

The beautiful blue jay is almost 12 inches long. Male and female are alike feathered in clear blue above, white and gray below. A showy crest of blue is outlined by a black band which extends around the neck like a collar. The wings and tail are blue, broadly tipped with white and barred with black. (For illustration in color, *see* Birds.) As the bird flies it loudly screams its name, "jay-jay-jay." Less familiar is the clear, bell-like two-syllabled "song." The blue jay's nest is woven of twigs and lined with bark and roots. The four to six eggs are olive-green or olive-brown, spotted with cinnamon brown.

Lumberjacks and campers of the northern forests know the social Canada jay as the "whisky jack" or "camp robber." It looks like a big chickadee, with black head, white throat and neck, and gray back, wings, and tail. The western subspecies, similar in appearance, is the Rocky Mountain jay.

Steller's jay and the long-crested and blue-fronted jays are abundant in the forested mountains of the West. These birds are indigo blue and black. The crest is very long and pointed. The Florida, or scrub, jay is found only along the coasts of Florida. The Florida jay and the California jay have pale brownish-gray backs, grayish-blue heads, necks, wings, and tails.

The scientific name of the blue jay is *Cyanocitta cristata;* of the Canada and Rocky Mountain jays, *Perisoreus canadensis;* of Steller's long-crested and blue-fronted jays, *Cyanocitta stelleri;* of the Florida jay, *Aphelocoma coerulescens;* of the California jay, *Aphelocoma californica.*

THOMAS JEFFERSON
—*Architect of* AMERICAN DEMOCRACY

This is Jefferson at 43, as painted by Mather Brown. It is the earliest known portrait of this famous American.

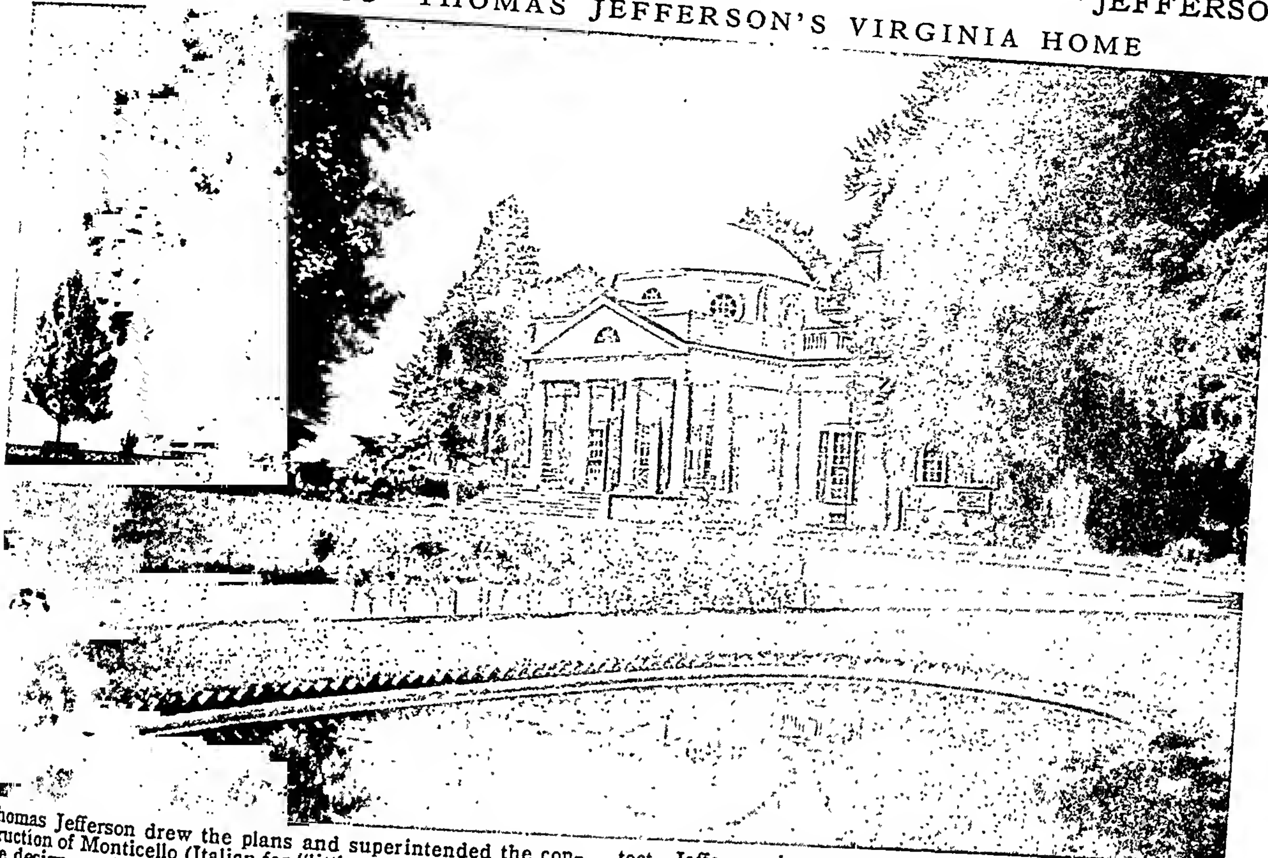
JEFFERSON, THOMAS (1743–1826). The third president of the United States was Thomas Jefferson. He was also the author of the Declaration of Independence and the Virginia Statute for Religious Freedom. Jefferson was the outstanding younger statesman of the American Revolution. In his long lifetime of public service, he played the major part in formulating and proclaiming the principles of American democracy.

Jefferson laid the cornerstones of the western expansion of the United States, and so he has become the hero of many of the states outside the original 13. His support of individual rights, of religious freedom, of freedom of speech, and of free intellectual inquiry have made him much more than a national hero. With Washington, he is one of the two heroes of the American Revolution whose fame has spread around the world. Washington is remembered as a man of action and Jefferson as a man of ideas.

Picture of the Man

Jefferson was a tall, straight-bodied, loose-jointed man. He stood and walked straight, and his shoulders were always square. He was hazel-eyed and freckled-faced; he had a long, high nose; and no one ever

MONTICELLO—THOMAS JEFFERSON'S VIRGINIA HOME



Thomas Jefferson drew the plans and superintended the construction of Monticello (Italian for "little mountain"). He based the design on the principles of Palladio, a noted Italian architect. Jefferson chose the highest hill on his estate and leveled off the top for the site. All materials except hardware and glass came from the estate. Planning and building took about 25 years.

thought of him as handsome. His hair was reddish, becoming sandy as he grew older. Even when he was an old man his hair was so plentiful that, unlike other gentlemen of his day, he never wore a wig.

In the fashion of his time, Jefferson dressed in a long, dark coat (usually blue, and in the summer generally of silk), a ruffled stock (in place of the modern necktie), a red waistcoat, short knee-breeches and shoes with bright buckles. Except in his days of courtship and married life, he paid little attention to clothes; and when he was president of the United States he made a habit of plainness, both in dress and in matters of ceremony.

He was a courtly person, bowing to everyone he met. He was reserved, and no one ever called him by his first name. He was a notably poor public speaker in an age of great orators. He talked in a thin, fine voice with his arms folded. He loved music, played the violin well, liked to sing, and usually hummed or sang as he walked or rode. A good horseback rider, he often rode for pleasure in a day when men generally rode only as a means of travel.

Great Ideas of a Great Man

Jefferson is often called the founder of the Democratic party, but many other political and nonpolitical groups claim the spirit of Jefferson as patron. He developed in practice the theory of states' rights, which opposed the centralization of authority in the federal government. He is known to everyone as the author of the ringing statement in the Declaration of Independence that all men are created equal; that among their inalienable rights are life, liberty, and the pursuit of happiness. His writings have stood as a beacon to the advocates of individual freedom, in spiritual as well as in worldly affairs.

Jefferson was the chief thinker and writer among a group of men who risked their lives, their fortunes, and their honor in fighting against a tradition. This tradition was that people need to be protected against themselves by the rich, the well-born, the educated, or the powerful. Jefferson was foremost among the influential men who believed that laws should be made by those who are to obey them.

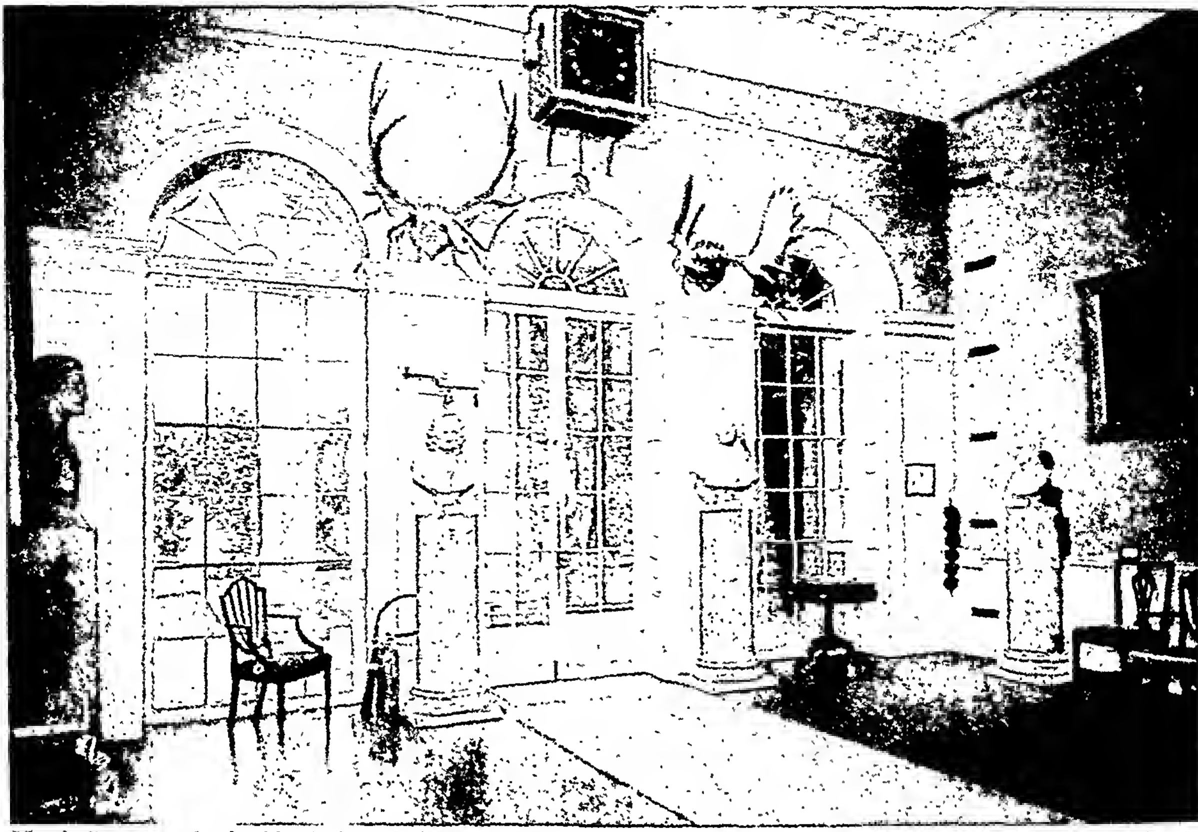
About 37 years after Jefferson's death Abraham Lincoln, in his Gettysburg Address, described the American government as "of the people, by the people, and for the people." He was defining with precision the kind of government that Jefferson, more than any other single man, made possible. Even Jefferson's closest co-workers thought of the rights of man as including the protection not only of life and liberty but above all, of private property. Their use of the expression "all men are created equal" excluded racial minorities. There is ample evidence that Jefferson did not exclude them.

Give the people light, said Jefferson, and they will find their own way. He meant *all* the people.

Ancestry and Early Life

Thomas Jefferson's father, Peter Jefferson, was a land surveyor of Welsh ancestry who moved west from

MONTICELLO'S CLASSIC GRACE ON DISPLAY



Monticello, now maintained by the Thomas Jefferson Memorial Foundation, is much as it was in Jefferson's time. It may be visited by tourists. Here is one of the rooms on display. It shows Jefferson's skill at adapting classic decorative themes; and many examples of Jefferson's ingenuity are present. The clock weight in the right corner tells the day of the week.

the Virginia tidewater settlements toward the frontier. His mother, Jane Randolph, was a blueblood of the old Virginia aristocracy. Jefferson was the third child and eldest son in a family of four sons and six daughters. Most of his brothers and sisters died in infancy. He was born April 13, 1743, at Shadwell, in the red western hills of Virginia in what is now Albemarle County and near the mountain on which he later built his permanent home, Monticello (pronounced *mon-ti-chel'lo*). Seven of his first nine years were spent at Tuckahoe, the Randolph estate "down east" on the James River near Richmond. He remembered, as a two-year-old, being handed up to a slave on horseback, who carried him on a pillow as they rode down the river road.

When Jefferson was nine, his family moved back to Shadwell. From his father and in the English school at Tuckahoe he had already learned to read and write, and by this time he could ride a horse. He learned to become a strong swimmer and to shoot straight. When not at school, he went with his father to hunt the deer and wild turkeys that were plentiful along the Rivanna River. He was first permitted to hunt by himself with a gun when he was ten, but before this he had been out alone at night hunting 'possum with his dogs.

Jefferson had started school when he was five, and at nine he entered boarding school. This was conducted by the Rev. William Douglas, a Scottish clergyman, whose pies he remembered as being moldy and whose instruction (except in the classics) he remembered as being excellent. When he was 14, his father died; he was then sent to the classical school of the able and learned Rev. James Maury. There he studied until he was ready for college.

At this time his outdoor sports were long walks in the mountains, hunting, riding, and swimming. He played the violin, danced, and very early formed the habit of reading for his own amusement. He learned classical and modern languages as a child, and he later said that this was the best time to learn them.

At 17 he entered William and Mary College (at Williamsburg, colonial capital of Virginia), and for two years studied mathematics, literature, and philosophy under a stimulating Scotsman, Dr. William Small. Small then arranged for him to study law privately under George Wythe. Wythe, later one of the signers of the Declaration of Independence, led Jefferson into the practice of law. He continued this work until the Revolution. Then the demands of public service interfered, and he never again resumed regular private practice.

While Jefferson was studying law at Williamsburg, the 1765 resolutions against the Stamp Act were proposed. From the door of the Virginia House of Burgesses the young law student heard Patrick Henry

make his "If this be treason" speech (*see* Henry, Patrick). Jefferson later said that "Mr. Henry . . . appeared to me to speak as Homer wrote."

Pre-Revolutionary Offices and Marriage

Elected to the Virginia legislature in May 1769, Jefferson served in it until the Revolution. There he was recognized as one of the outstanding young revolutionists. He was a member of the 1774 Virginia convention, and although unable to attend because of illness his resolutions written for it resulted in the publication of his first work, 'A Summary View of the Rights of British America'. He did attend the Virginia Convention of 1775, and he was a delegate to the Continental Congress in both 1775 and 1776. It was this Congress that declared the independence of America in Jefferson's immortal words (*see* Declaration of Independence).

When Jefferson was 28 he married a 23-year-old widow, Martha Wayles Skelton, on New Year's Day, 1772. During their nearly 11 years of happy married life, his wife bore six children. Only two of them, Martha (nicknamed Patsy) and Maria (baptized Mary, but always called Polly by her father), survived the rigors of 18th-century childhood. Patsy, tall like her father, married and had several children. Polly was small and pretty like her mother. She died in her middle twenties after the birth of her second child, just as Jefferson was about to begin his second term as president.

Martha Jefferson never recovered from the birth of her sixth child. She died Sept. 6, 1782, and Jefferson inscribed on her tombstone, in the Greek original, two lines from the 'Iliad':

> If in the house of Hades, men forget their dead,
> Yet will I even there remember my dear companion.

He never remarried. (*See also* White House, subhead "Hostesses of the White House.")

State Government and First Retirement

In September 1776 Jefferson left the Continental Congress and the following month re-entered the Virginia House of Delegates. There he served until he was elected governor of Virginia in June 1779. As a lawmaker he started with a broad program of reform in mind. He had served only five days in the legislature when he moved for a complete revision of the laws. He was immediately elected to the Board of Revisors. For the next two years he worked with thoroughness and success, helping to build a legal system in which he hoped "every fiber of ancient or future aristocracy" would be erased and a foundation laid for a government of the people.

Jefferson proposed many bills which struck directly at the old aristocracy of wealth and birth in favor of government by those of talent and virtue. Four of these bills demand special mention:

1. *The bill abolishing entails,* that is, repealing laws permitting land and other wealth to be set aside for the benefit of one line of descendants, who might enjoy the profits but who could never sell or divide the estate. In this repeal Jefferson considered that the land of his country had been saved from the dead hand of the past.

2. *The bill abolishing primogeniture,* that is, repealing the laws giving to an eldest son all his father's property, leaving nothing to the other sons and daughters.

3. *The statute for religious freedom,* separating church and state and removing the private right of conscience from control by public law. This statute has come down to us as one of the timeless declarations of intellectual freedom.

4. *The bill for general education,* allowing everyone, without regard to birth or wealth, to have as much free education as he was fitted for.

All these bills were not immediately passed; and Jefferson's general plan for education has not yet been completely put into action. However, elements of it are at the root of all our public school and free library systems.

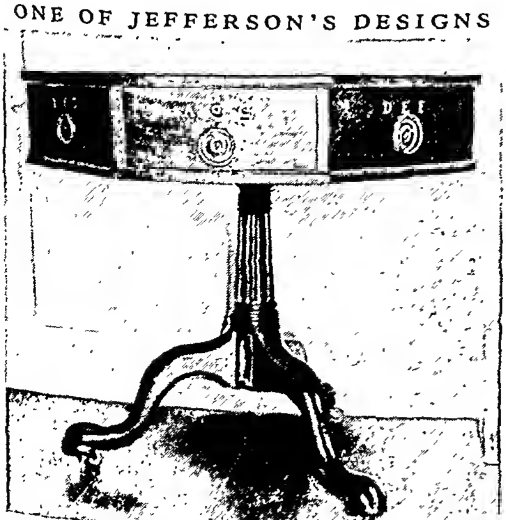
As governor of Virginia during the Revolution, Jefferson's talents were less well employed than as a legislator. He took formal possession of the vast Northwest Territory won by George Rogers Clark; and he did what he could to raise supplies and men for the Revolutionary army. He moved the capital of Virginia from Williamsburg to Richmond, but he was unsuccessful in defending the state from British invasion. (*See also* Virginia.)

His hesitancy in taking unconstitutional steps in a time of crisis cost him popular support. His influence remained strong enough, however, to overcome the movement by Patrick Henry and Richard Henry Lee for the appointment of a dictator. In 1781 Jefferson retired to his home, his books, and his family, intending never to re-enter public life. It was in this period that he began writing his only full-length book, 'Notes on the State of Virginia'.

Congress Again

This first retirement was brief. Within little more than a year his wife died. Jefferson re-entered Congress, throwing himself once more into the work of

ONE OF JEFFERSON'S DESIGNS



Typical of Jefferson's clever contrivances is this table used at Monticello. The table top revolves and the wedge-shaped drawers, each alphabetically labeled, serve as filing cabinets.

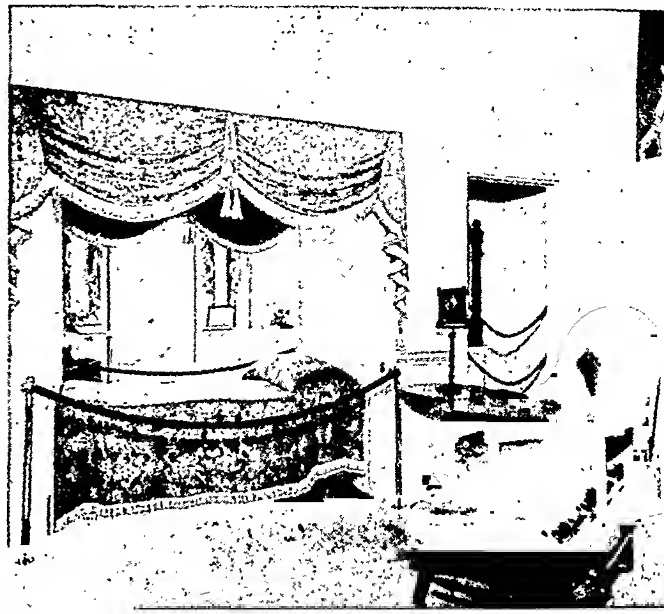
lawmaking, this time for the national government. In less than two years he wrote some of the most significant state papers of the Continental Congress. Three reports were especially noteworthy:

1. *On Government for the Western Territory,* the basic document for the western expansion of the United States, in which Jefferson's effort to abolish slavery failed by a margin of one vote.

2. *The provision in the 1784 Instructions to the Ministers,* in which it was proposed that negotiated treaties should specify that in wartime unfortified towns remain unmolested by the armed forces of the enemy.

3. *The Notes on the Establishment of the Money Unit,* which led to the adoption of our present decimal system of copper pennies, silver dimes, and dollars. Neither the 2-dollar bill nor the common 5-cent piece, both of which carry pictures of Jefferson and of his home, was among the monetary units he proposed.

BEDROOM AT MONTICELLO



The frame of the bed is a pair of rails attached to the walls of the passageway. It could be dismantled quickly. The writing table and the chair, with its comfortable leg support, were also designed by Jefferson.

France

In 1784 Jefferson sailed for Europe accompanied by his daughter Patsy (Polly joined them later). With Franklin and John Adams he was one of the ministers who were to negotiate treaties of commerce. In 1785 he was appointed to succeed Franklin as minister to France. He stayed in Europe until the fall of 1789, practicing with skill the diplomatic arts of peace.

He worked out a plan for collective action against the Barbary states, whose piracies in the Mediterranean were threatening the peace. This plan was adopted by Congress but was doomed to failure because of the lack of European co-operation. He smuggled rice seed out of Italy for planting in South Carolina and Georgia. He drew an architectural plan based on the Maison Carée at Nîmes for the new state capitol at Richmond. He conspired with Lafayette to introduce republican government into France. Finally, with characteristic zeal and foresight, he notified Congress of the French invention of a stamping press that could mass produce machine parts.

Secretary of State and Second Retirement

Jefferson returned to Monticello just before Christmas 1789. He brought Patsy and Polly home and gave Patsy's hand in marriage shortly after their arrival. The slaves at Monticello gave the travelers a rousing welcome.

The Federal Constitution had been adopted in Jefferson's absence, and immediately upon his return he was offered a post in Washington's Cabinet. Jefferson accepted with great hesitancy. He became the first secretary of state under the new constitution. From then until his final retirement, with but one intermission, Jefferson was at the center of a whirlwind of complex and bitter politics.

During his absence in Europe, the reaction from revolutionary liberalism had been severe. Jefferson viewed the mounting power of the conservatives, especially as represented in the persons first of Alexander Hamilton and later of John Adams, with dread. To him this mounting power meant the overthrow of republican government in favor of rule by an upper class. For the rest of his life he believed that the defeat of the Federalists (as the conservatives were then called) saved the United States from monarchy. (*See also* Hamilton, Alexander; Adams, John.)

In spite of his open and growing hostility to Hamilton, his loyalty to George Washington persuaded him to stay in the Cabinet until the end of 1793. In his 51st year he again retired to his home, his farm, and his private debts.

Jefferson as Vice-President

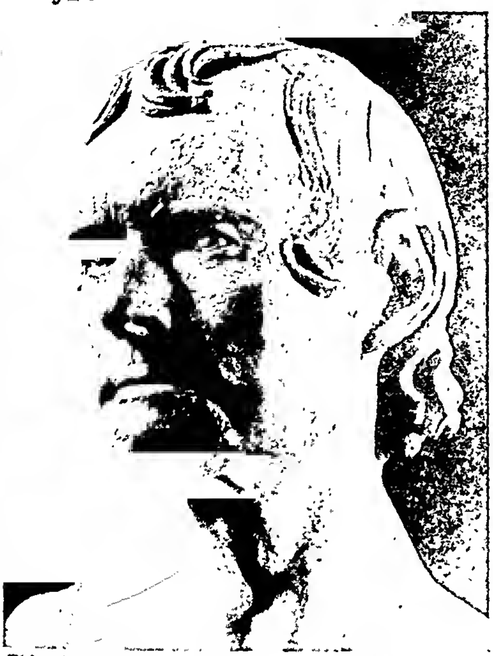
Although Jefferson thought of this retirement as final it actually lasted less than three years. In 1796 he was elected to the vice-presidency when John Adams was elected president. As presiding officer of the Senate he wrote the 'Manual of Parliamentary Practice', which is still used in modified form by the present-day Congress.

While vice-president he secretly drafted the Resolutions of 1798 for the Kentucky and Virginia legislatures against the Alien and Sedition Acts (*see* Alien and Sedition Acts). These Kentucky Resolutions claimed the right of the states to nullify acts of the Federal Constitution believed to be unconstitutional. They were especially remembered in the days of the Civil War for their advocacy of states' rights principles; but their central objective—as Jefferson saw it—was the defense of personal liberty and individual freedom (*see* States' Rights).

Elected President

By 1800 Jefferson's break with the Federalists was final. With Aaron Burr he ran for president against John Adams, once his old friend but now his political

JEFFERSON IN OLD AGE



This plaster mask was made directly from Jefferson's features by John H. I. Browere, who then modeled it as a sculptured bust.

opponent. Jefferson's new Republican party (as the Liberals were then called) won the election; but under the original system of electoral votes both the party's candidates were considered to be running for president. The one who won the most votes became president; the other candidate became vice-president. There was a tie between Jefferson and Burr for the presidency. The tie was resolved in Jefferson's favor by vote in the House of Representatives after more than 30 ballots (*see* President). Jefferson's election to a second term in 1804 was virtually without opposition.

Jefferson was the first American president to be elected in a two-party campaign. He was the first president to be inaugurated in Washington, D. C., and he was the first to start his term in the new White House. He had much to do with the design of the capital. Jefferson's presidency helped shape the destinies of the nation for more than a century, guaranteeing not only its greatness, but also some of its disasters. (*See also* United States History.)

In an effort to restore a balance of Republicans in government office, Jefferson started what came to be regarded as the "spoils system." He tried unsuccessfully to control the Supreme Court in the interests of the will of the people. He negotiated the purchase of the vast territory of Louisiana on doubtful constitutional grounds and launched the Lewis and Clark Expedition (*see* Lewis and Clark Expedition; Louisiana Purchase). He was responsible for the fighting of our first war as a nation, on the shores of Tripoli against the Barbary pirates. His efforts to prevent a second war with England only postponed it until 1812 (*see* War of 1812).

Jefferson was slow but successful in meeting the first real threat to the new American union. Aaron Burr was accused of making a presumably treasonable effort to set up an independent government in the Southwest, and this was halted before it had scarcely begun (*see* Burr). However, in the trial that followed the suppression of this Burr conspiracy, Jefferson's personal animosity toward Burr and toward Chief Justice John Marshall did him little credit (*see* Marshall, John).

His Embargo Act was a daring and original, although eventually unsuccessful, means of keeping the peace (*see* Embargo Acts). However, it may have been one of the most successful and inspired diplomatic moves of the young republic. In effect it applied economic sanctions against Britain and France, who were at war with each other. It was Jefferson's answer to the British Orders in Council and the Impressment Acts, which were directed against neutral (in this case, mainly American) shipping. The Embargo Act stopped American shipping, thus in intent depriving European nations (particularly Britain) of some of the raw materials needed to carry on the war.

The act also had the effect of destroying the Southern economy, thus alienating Jefferson's chief supporters. It also forced his political enemies in New England into substituting—against their will—a manufacturing economy for their shipping trade. Thus one far-reaching effect of the Embargo Act was to give New England an economic supremacy which it was to enjoy for more than a century. From this economic power came money to establish political power and to build the great universities which made New England a center of intellectual activity.

Most creditable of all Jefferson's performances as president was his unwavering insistence on the freedom of the press. He stood firm in this even when he himself was the object of the most slanderous and malicious succession of personal libels ever unleashed by irresponsible newspapers.

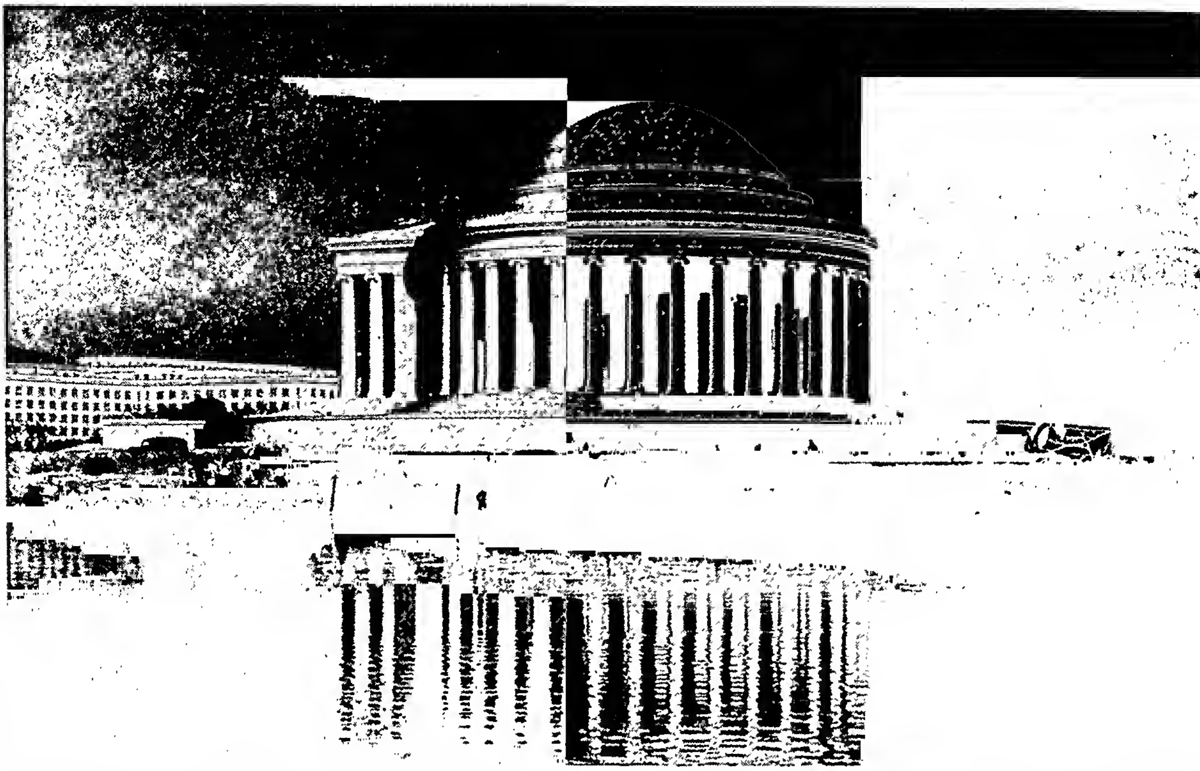
With the failure of the Embargo Act, Jefferson finally and permanently retired from public life to his home at Monticello. There he spent the last 15 years of his life, devoting himself to his lands, his friends, his correspondence, his books, and his financial problems. He also devoted himself to the establishment of the University of Virginia at Charlottesville, which opened in 1825. Jefferson died July 4, 1826, exactly 50 years after the adoption of the Declaration of Independence and on the same day as his old friend and political rival, John Adams.

Jefferson's Versatility

Most people tend to think of Jefferson as a statesman only. Actually he was one of the most versatile and accomplished men who ever lived. As an agriculturist, he invented a mold board plow that was widely used for many years. He introduced the threshing machine into the United States, and he encouraged Robert Mills in the development of his mechanical reaper. He was one of the first Americans to employ crop rotation and contour plowing.

As a scientist he suggested the invention of the stop watch in which he was interested not for timing

THE JEFFERSON MEMORIAL IN WASHINGTON, D. C.



This monument to the memory of President Thomas Jefferson stands on the Tidal Basin in the national capital, with the Washington Monument and the Lincoln Memorial. The splendid colonnaded structure was designed by John Russell Pope in the classic Greco-Roman style that Jefferson admired. The exterior material is shining marble; the building was completed in 1942.

races but for making astronomical observations. He was one of the earliest believers in the submarine, and he was one of the first prominent men in the United States to submit to inoculation for smallpox. He had his children inoculated as well.

As an architect, Jefferson designed the 35-room Monticello, one of the most beautiful historic homes in America. He also designed the capitol at Richmond and the original buildings for the University of Virginia. He used elevators and conveyers in his own flour mill and nail factory, and among the mechanical contrivances at Monticello there were dumb-waiters, hidden staircases, and an interior weather vane connected with one on the roof. In Monticello's 13 bedrooms, all the beds were simply mattress supports hung on wall hooks. He is said to have invented the lever-operated double door opener, seen today on streetcars and buses, and the folding chair both of the common type and of the walking-stick type, now used at field sports. Even in his own day he was "accused" of inventing the swivel chair. He is often called the Father of the Patent Office, because the nation's first patent laws were administered by him as secretary of state. One of his official acts was to grant Eli Whitney a patent for the cotton gin.

Jefferson was an able linguist. In addition to mastering Greek and Latin at school, he learned several modern languages, especially Spanish; and he made pioneer studies of American Indian languages. He collected books all his life—and read them as well. Late in life Jefferson sold his cherished library of 10,000 volumes to the United States government. His books replaced the government collection burned by the British during the War of 1812; the Jefferson collection became the nucleus of the vast modern Library of Congress.

No one with a knowledge of only a few aspects of Jefferson's life can have any grasp of the depth and complexity of Jefferson's character. Jefferson was at the same time one of the simplest and most complicated men in history. It is completely characteristic

JEFFERSON'S ADMINISTRATIONS
1801-1809

Ohio admitted as a state (1803).
Louisiana Purchase (1803).
Lewis and Clark Expedition to the Pacific (1804).
12th Amendment to Constitution providing separate ballots for president and vice-president (1804).
War against Tripoli (1801–5).
Trial of Aaron Burr (1807).
Importation of slaves into United States forbidden (1808).
Fulton's steamboat makes successful trip (1807).
Disputes with France and England over neutral commerce.
Impressment conflicts with England ('Chesapeake' affair, 1807).
Embargo Act in force (1807–9).

that a man who had held the highest offices in his state and nation should ask that his tombstone be inscribed with these simple words:

Here was Buried
THOMAS JEFFERSON
Author of the
Declaration
of
American Independence
of the
Statute of Virginia
for
Religious Freedom
and Father of the
University of Virginia

BIBLIOGRAPHY FOR THOMAS JEFFERSON

Books for Younger Readers

Lisitzky, G. H. Thomas Jefferson (Viking, 1933).
Van Loan, H. W. Thomas Jefferson (Dodd, 1943).

Books for Advanced Students and Teachers

Bowers, C. G. Jefferson and Hamilton; the Struggle for Democracy in America (Houghton, 1925).
Bowers, C. G. Jefferson in Power (Houghton, 1936).
Bowers, C. G. Young Jefferson, 1743–1789 (Houghton, 1945).
Malone, Dumas. Jefferson and His Times, 2 v. (Little, 1948, 1951).
Martin, E. T. Thomas Jefferson, Scientist (Schuman, 1952).
Mayo, Bernard, ed. Jefferson Himself (Houghton, 1942).
Rosenberger, F. C., ed. Jefferson Reader (Dutton, 1953).

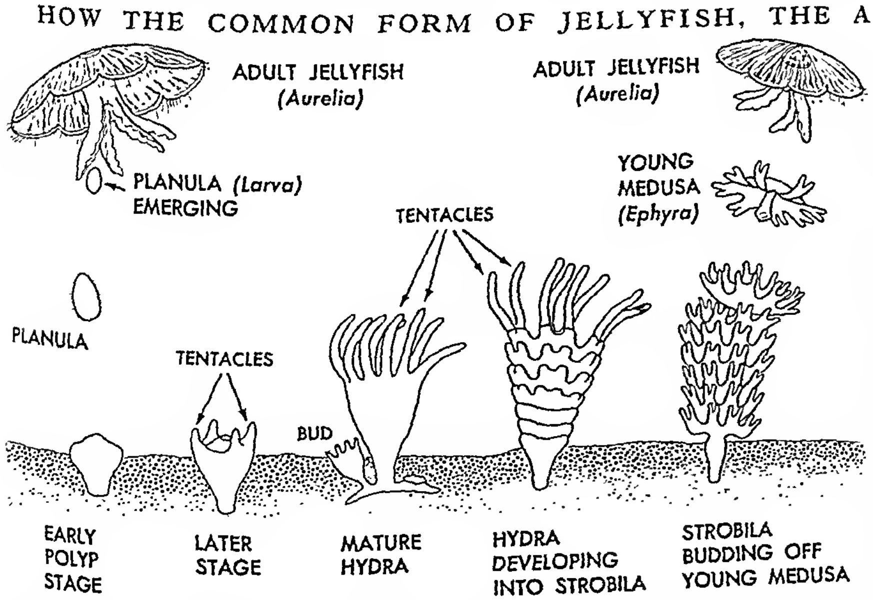
JEFFERSON CITY, Mo. When selected in 1821 as the site for the state capital, Jefferson City was known as Lohman's Landing. It lay on the south bank of the Missouri River, near the center of the state, and had only a mission, a tavern, and a blacksmith shop. The town was named for Thomas Jefferson; it was incorporated in 1825. The next year, when the legislature first met here, it had 31 families, a general store, a hotel, small tanneries, a gristmill, and a distillery. In 1839, with a population of about 1,000, it was incorporated as a city. Rail service to St. Louis began in 1856.

Modern Jefferson City, a trade center for a fertile farming region, is dominated by the great, gray dome of the Capitol, rising from a riverside bluff. From this bluff the city extends east, south, and west over ridges and valleys paralleling the south bank of the river. The limestone-faced Capitol, completed in 1917, contains museums of state resources and history; its interior has some noted art works, including murals by Thomas Hart Benton. Across a park lies the three-story Governor's Mansion (completed in 1871), and nearby are the eight-story State Office Building (1938) and the Supreme Court Building (1907). Lincoln University, in the southeastern section of the city, opened as a school for Negroes in 1866; it was taken over by the state in 1879. Jefferson City also has a junior college.

The state penitentiary (with an adjoining women's prison) and the city's industrial district lie along railroad tracks under the riverside bluffs. The modern industries include clothing and shoe factories, a brewery, printing plants, and railroad repair shops. The city has the mayor-council form of government. (*See also* Missouri.) Population (1950 census), 25,099.

JELLYFISH. Among the strangest of sea animals are the jellyfish, or *medusae.* They are called "medusae," because they have many waving tentacles that resemble the snakelike hair of Medusa in Greek mythology. Strange cousins of the jellyfish are the corals and sea anemones. These three belong to the great group of animals known as *Coelenterata.*

HOW THE COMMON FORM OF JELLYFISH, THE AURELIA, DEVELOPS



The fertilized egg, lodged in the mouth folds of the female, develops into a larva, the *planula.* It breaks away and swims to a spot where it becomes fixed. It turns into a polyp with long tentacles and forms buds from which new polyps develop. Then it elongates, and a series of horizontal segments appear, like a pile of saucers. One by one, the "saucers" break off and swim away as young jellyfish. The different stages are known as the polyp, hydra, strobila, ephyra, and medusa. At the right are aurelias in various stages of development. One ephyra (young jellyfish) has just broken off and is swimming away.

The jellyfish has none of the characteristics of fish. It has no skeleton, and more than nine-tenths of its body is jellylike. In some forms not much more than one per cent is really living matter. There are a thousand kinds, varying in form, size, and color. A typical jellyfish may be umbrella shaped, with few or many feelers, or tentacles. Sometimes it has simple eyes around the edge of the umbrella. The mouth and stomach are in the "handle" of the umbrella. Simple muscles on the under side contract the body much like the closing of an umbrella and enable the jellyfish to swim. The tentacles have explosive cells which paralyze other small animals. Then the tentacles draw them into the mouth of the jellyfish. A network of nerves runs beneath the lining of the umbrella and coördinates the muscles as they perform simple actions.

During most of their lives, the larger jellyfish swim about freely. Many reproduce by the process shown in the picture. Some smaller jellyfish spend most of their lives as attached polyps. A new individual is produced from a fertilized egg and swims about for a short time. Then it attaches itself to rocks or seaweed and develops an internal cavity, a mouth, and tentacles. From each polyp others develop as buds. Some of them remain attached to the parent and form a colony. Others break away and become jellyfish. The budding process, following reproduction by fertilized eggs, is called alternation of generation.

Some jellyfish are scarcely large enough to be seen. Others are two feet or more in diameter. Some are very delicate. Others are almost as firm as gristle. Jellyfish may be transparent, or brown, pink, white, or blue. Some are egg shaped or like ribbons. Others are even more strange, like the Portuguese man-of-war. Most jellyfish live at or near the surface of the sea. A few live at the bottom where the water is a mile or more deep. Some are phosphorescent and look like great balls of fire when struck.

JENNER, EDWARD (1749-1823). For centuries smallpox was a scourge. The dread disease killed or left weakness and hideous scars. Then late in the 18th century young Dr. Edward Jenner startled the medical society of Berkeley, England, by claiming that people who had had cowpox would not get smallpox. Many farmers had known this for years but doctors scorned Jenner's theory. He continued to experiment and to publish his successes. After many years, doctors began using Jenner's method of preventing smallpox. He called the method *vaccination*, and it has virtually wiped out smallpox in every country that uses vaccination widely (*see* Vaccination).

Jenner was born on May 17, 1749, in the little English town of Berkeley in Gloucestershire. His father was the parish vicar. Edward early became interested in natural history. By the time he was 13, he decided to be a doctor. As was the custom at that time, he began as an apprentice to Dr. Daniel Ludlow, who lived near Bristol. One day he heard a young farm girl tell the doctor that she couldn't contract smallpox because she had suffered from cowpox already. This started Jenner's theory. When he went to London in 1770 for his internship, he stayed with Dr. John Hunter, a great English surgeon and anatomist. Jenner spoke of his idea that smallpox and cowpox were related diseases, but Hunter thought little of the suggestion.

In addition to his studies, Jenner arranged and mounted the biological specimens brought back by Sir Joseph Banks from the first Pacific expedition of Capt. James Cook. Jenner was asked to join the second expedition, but refused. In 1773 he returned to Berkeley and began his practise. In 1788 he married Catherine Kingscote. They had two sons.

FATHER OF VACCINATION

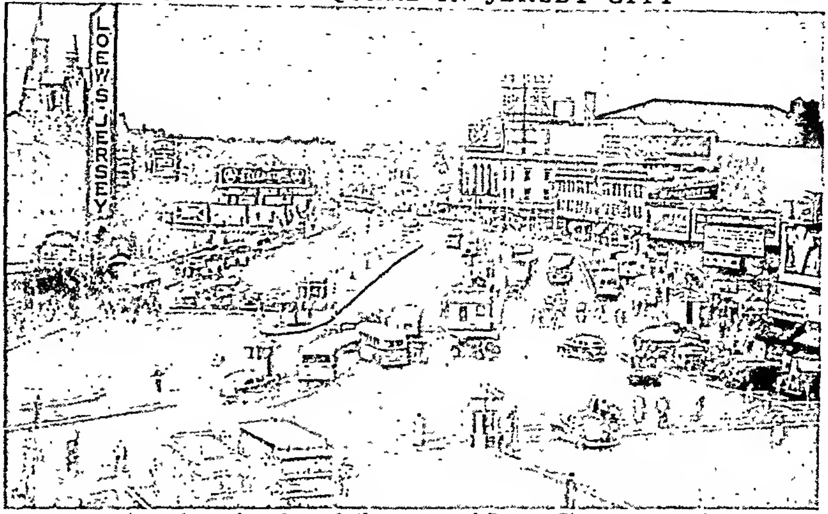
Dr. Jenner's fight to spread the practise of vaccination halted the scourge of smallpox.

While he carried on his local practise, Jenner continued to experiment with cowpox. He found that there were two forms of cowpox. But only one would immunize a person against smallpox. And the true cowpox was a modified form of the more infectious and contagious smallpox. At last he was ready to test his theories. In 1796, Jenner inoculated a healthy eight-year-old boy, James Phipps, with cowpox. Two months later he exposed the child to smallpox, but the boy did not get the disease. Jenner wrote a paper in 1798 explaining his experiments, but it was coldly received in medical circles. He then went to London to demonstrate his theory. No one would submit to vaccination. Discouraged, Jenner returned to Berkeley. Meanwhile, a successful vaccination by a London physician revived interest in Jenner's theory. The doctors were finally convinced.

Jenner's great contribution was recognized abroad and honors were heaped on him. But England was slow to accept his discovery. Many vaccinations failed through ignorance and carelessness. Jenner's enemies spread the news of these failures. To find time to answer these attacks and to advance his theories, Jenner gave up his practise. He soon needed money. Friends appealed to the government for a grant to honor him for his discovery. After much delay the money was appropriated. Several years later Jenner was granted an additional sum. The resulting controversy troubled him, but he spent the rest of his life spreading the use of vaccination.

JERSEY CITY, N. J. A section of the Greater New York metropolitan area, Jersey City is an important transportation and manufacturing center. The city lies on a peninsula formed by the Hudson River and Upper New York Bay on the east, and the Hackensack River and Newark Bay on the west. Many trunk-line railways link the south and west with Jersey City. They haul freight to terminals on the city's docks. There the cars are transferred to ferry boats bound for New York City docks. At Jersey City also, rail cargo is loaded on ocean vessels.

JOURNAL SQUARE IN JERSEY CITY



Hudson Boulevard, cutting through the center of Jersey City, broadens into Journal Square. This busy plaza serves as a terminal for local and interurban busses.

Fast passenger transportation to and from New York City is provided by a rapid-transit electric line through the Hudson Tubes and by the Holland Tunnel for motor vehicles. In Jersey City, the Holland Tunnel connects with the Pulaski Skyway, a towering overhead highway leading to Newark. The main north-south city route is the Hudson Boulevard, 19 miles long and 100 feet wide. It gives an excellent view of the Hudson River and upper New York City. The city has an extensive system of public parks and playgrounds.

Jersey City's manufactures include iron and steel products, chemicals, electric fixtures, cans, asbestos, soap, and drugs. In the city are a state teachers college, John Marshall College, St. Peter's College of Arts and Sciences, and Jersey City Junior College. The first settlement was in 1630 and was named Paulus Hook. Later it merged with seven nearby communities. Population (1950 census), 299,017.

The SACRED CITY *of* THREE FAITHS

JERUSALEM. "If I forget thee, O Jerusalem, let my right hand forget her cunning!" So sang the Hebrew psalmist in exile as he mourned the loss of his holy city and yearned for its restoration to his people. In the Middle Ages Christians joined the Crusades with high zeal to rescue the city of Christ from Mohammedan rule. But the Moslems held stubbornly to Jerusalem as a sacred city second only to Mecca and Medina. They believed that from it their prophet Mohammed ascended to heaven.

Thus Jerusalem is a holy city for three faiths. Its location makes it important also as the center and guardian fortress point for a considerable region.

The city lies 2,500 feet above sea level in the mountain region of Palestine between the Mediterranean and the Dead Sea. Deep ravines on three sides made it easy to defend in the days before firearms. To the east and southeast is the Valley of Kedron. To the south and southwest is the Valley of Hinnom, or Gehenna. In this ravine the Phoenicians made human sacrifices to the god Moloch, and here were cast the bodies of criminals. Thus the name Gehenna became synonymous with Hell, a place of torment after death.

A TRADING CENTER IN OLD JERUSALEM


Here a mixed throng is shopping in David Street in the old city. The archway and awnings are typical of the quarter.

Ancient Walls and Holy Places

Jerusalem is really two cities—the old walled city and the new city covering a much larger area outside. The walls have been destroyed and rebuilt many times. The present wall was built for the most part by Sultan Solyman the Magnificent in the 16th century. Eight gates open into streets so narrow that no wheeled vehicle can pass through them. They are paved with uneven, slippery cobblestones. Some are arched overhead like the aisles in a cathedral.

The splendid Temple, which was the center of worship for all Israel, has vanished

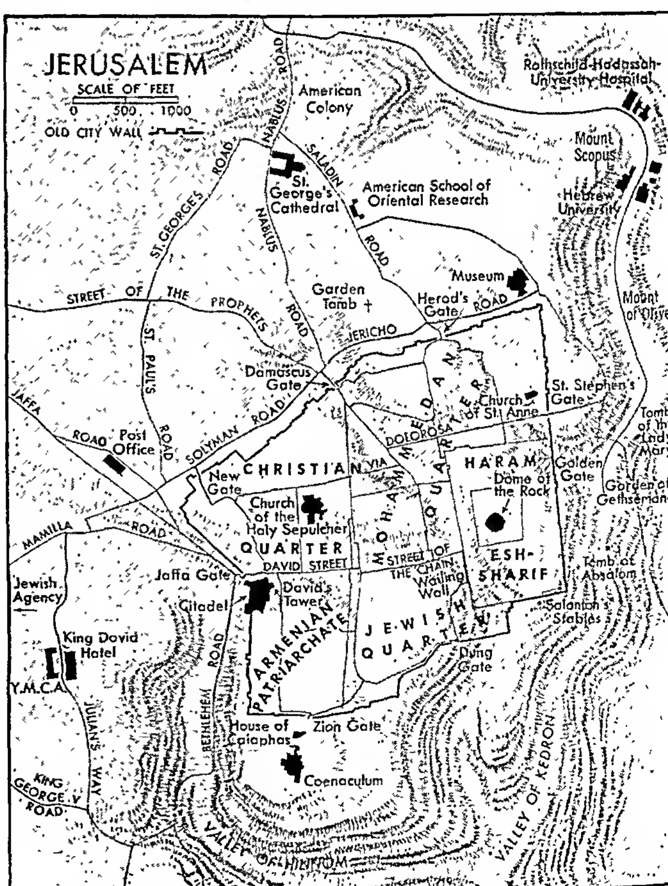
OLD WALLS AND THE TOWER OF DAVID

Easter pilgrims are massed at the foot of the so-called Tower of David, which was built by King Herod the Great. It forms a portion of the old city wall. The road near the center of the picture leads to Bethlehem.

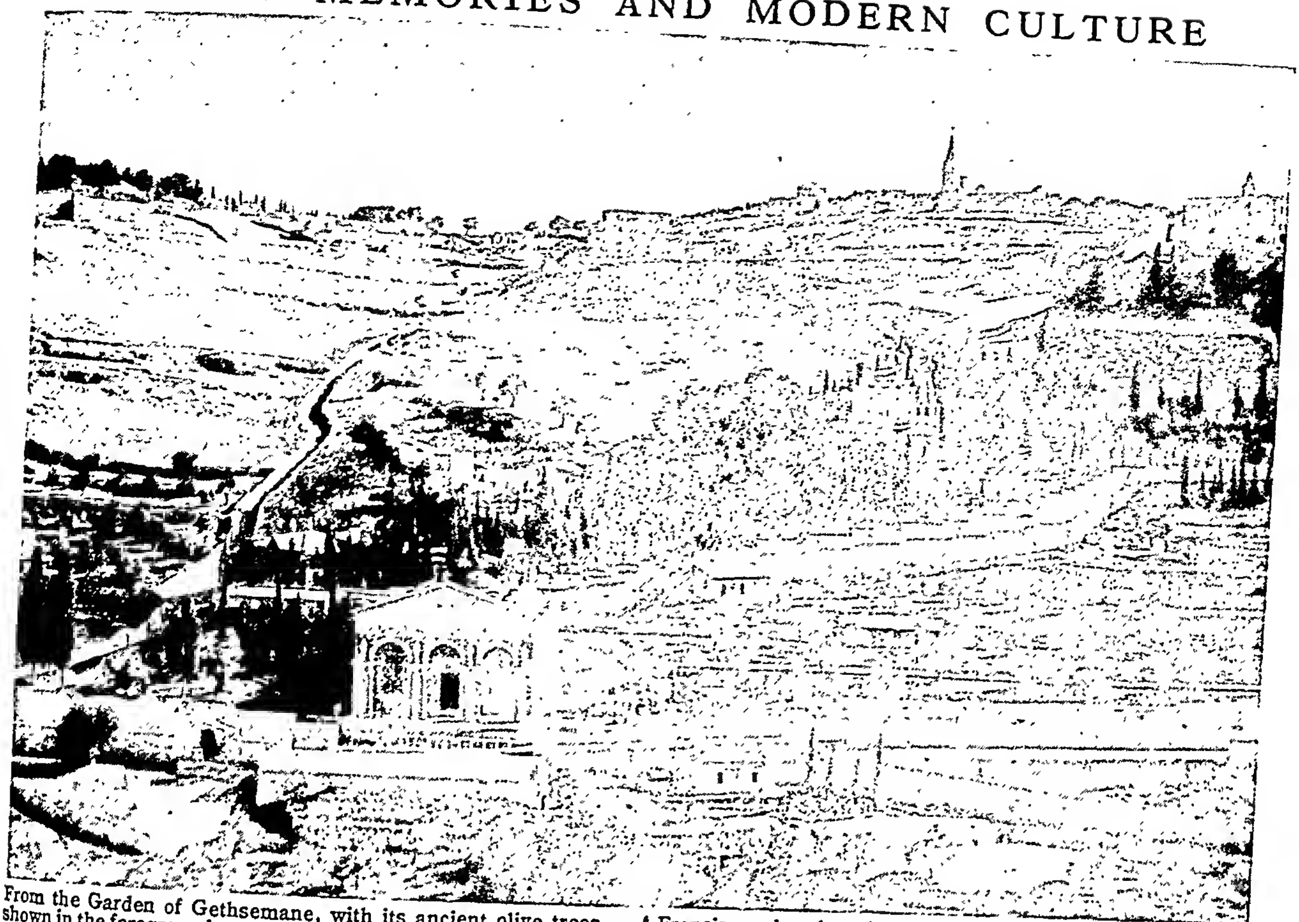
utterly. But the Wailing Wall, where Jews gather every Friday to mourn and pray, is thought to be a remnant of the outer wall around the Temple area. On the supposed site of Solomon's Temple is a beautiful Mohammedan mosque built of marble and colored tiles. This is the Dome of the Rock, often but incorrectly called the Mosque of Omar. It is built over the "foundation rock." Here, according to legend, Abraham offered to sacrifice his son Isaac. The Dome is the center of a group of buildings occupying the area called Haram esh-Sharif.

The place most visited by Christian pilgrims is the Church of the Holy Sepulcher, built over the supposed tomb of Jesus. The oldest part of the present structure dates from the 12th century. Some authorities believe that the real burial place is the so-called Garden Tomb outside the city walls. No man can point with certainty either to Golgotha, the site of the crucifixion, or to the place of Christ's burial. The Via Dolorosa (Way of Sorrows) marked with the 14 stations of the cross, may not be exactly the way Christ followed. Nevertheless the devotion of countless pilgrims has hallowed these spots.

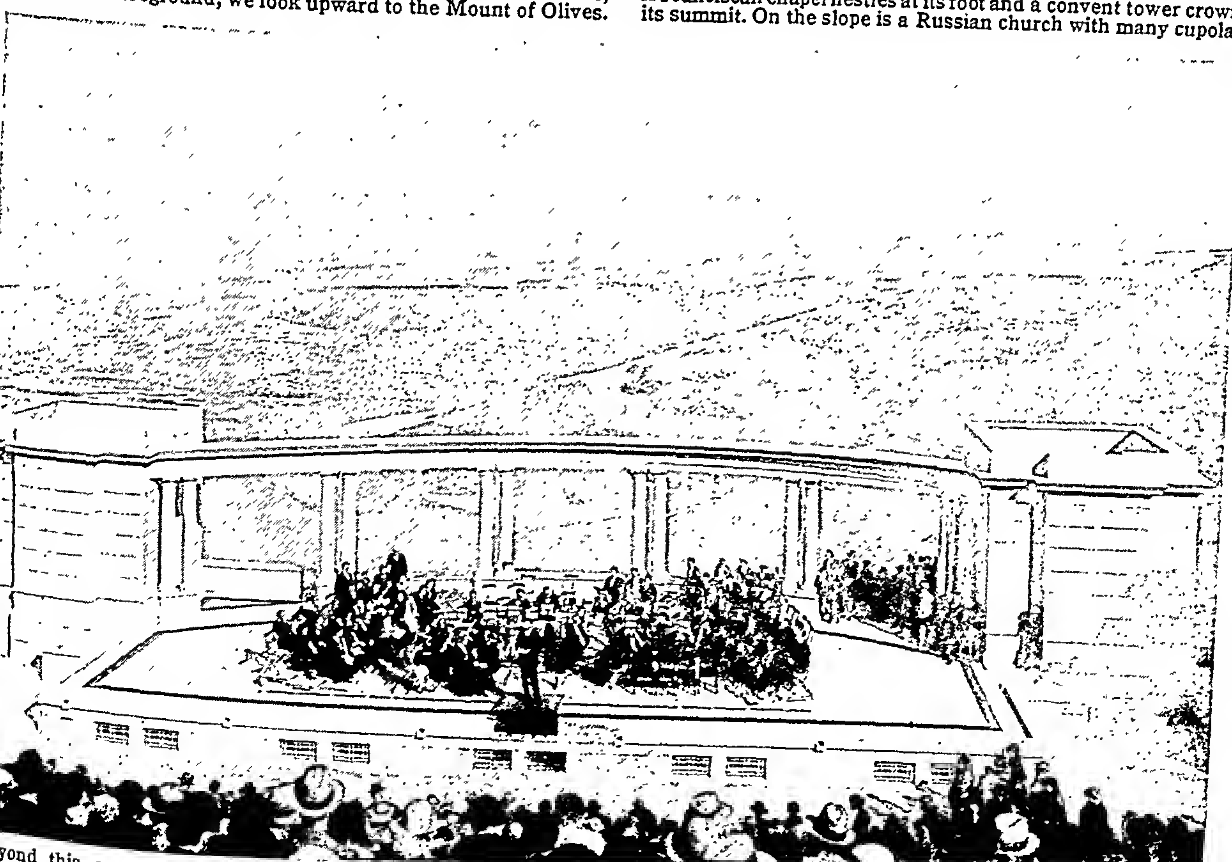
Just outside the walls to the east is the Garden of Gethsemane, carefully tended by Franciscan monks. Here several ancient olive trees are pointed out as the very ones in whose shadow Jesus knelt and prayed in anguish. Above the garden rises the Mount of Olives, associated with many scenes of religious history. Near by, to the northeast of the city, is Mount Scopus, used as a lookout in ancient times. On it stand the modern buildings of the Hebrew University, founded in 1925 as a center of Jewish culture. Here also is the Rothschild-Hadassah-University Hospital, the largest and finest hospital in the Middle East. This point affords a magnificent view of the city on one side, and on the other of the wilderness of Judea and the Dead Sea.



In the old city are holy places of three religions. Beyond its walls, on ground also hallowed by tradition, a modern city has been built.



From the Garden of Gethsemane, with its ancient olive trees, shown in the foreground, we look upward to the Mount of Olives. A Franciscan chapel nestles at its foot and a convent tower crowns its summit. On the slope is a Russian church with many cupolas.



yond this open-air theater of the Hebrew University, on ount Scopus, the wilderness of Judea spreads to the Dead Sea. No classes have met in the university buildings since 1948, when the campus was cut off from Israel by the Arabs.

WAILING PLACE OF THE JEWS IN JERUSALEM

"If I forget thee, O Jerusalem, let my right hand forget her cunning!" So sang the Hebrew psalmist in exile from the Holy City of his faith, and the Jews in Jerusalem itself still come to this wailing place every Friday to mourn and pray. Those Hebrew carvings on the wall are prayers of pilgrims.

New Jerusalem, outside the walls, has broad avenues, gardens, modern apartments and office buildings, hotels, stores, and cafés. The new city, as well as the old, has a general air of dignity and solidity. Practically all its buildings are built of a beautiful hard stone taken from the very hills beneath the city. Jerusalem, new and old, is one of the most cosmopolitan and colorful of cities. Its irresistible appeal has drawn people from all parts of the world. Here almost every language can be heard. The vestments of dozens of religious orders are seen mingled with the robes of the Arabs and the modern dress of the Western world.

Long and Troubled History of Jerusalem

The name Jerusalem means "city of peace," but probably no other city in the world has been the center of more warfare. In the many terrible sieges Jerusalem has suffered, lack of water has been its chief weakness. Not until 1936 was the water shortage remedied, with completion of a 40-mile pipe line from the headsprings of the Yarkon River.

Jerusalem is mentioned in the Tel-el-Amarna letters as being occupied by the Egyptians in the 14th century B.C. Archeologists have found evidence of its existence as a place of worship long before this. At the time of the Israelites' entrance into Palestine it was held by the Jebusites, a Canaanite tribe. David conquered it and made it the capital of his kingdom. The city reached its greatest splendor under Solomon. After the division of the kingdom it was the capital of Judah. During succeeding centuries Jerusalem suffered countless sieges and was plundered, destroyed, and rebuilt again and again, as it fell into the hands of the Assyrians, Babylonians, and Persians, Alexander the Great, the Egyptian Ptolemies, the Syrians, and the Romans. The Roman general Titus brought about what appeared to be its final destruction and the end of the Jewish nation in A.D. 70.

About A. D. 130 the Emperor Hadrian rebuilt the city and named it Aelia Capitolina. In the 4th century Constantine the Great ordered the restoration of the holy places and the erection of churches. In 637 Jerusalem was won by the Moslems. Except for brief intervals, when it was held by the Crusaders, it remained under Moslems—first Arabs, then Turks—until 1917. In December of that year it fell to British forces under General Allenby. After the first World War it became the capital of the British mandate of Palestine.

In November 1947, the United Nations proposed dividing the Palestine mandate between Jews and Arabs and setting up international rule over Jerusalem. In May 1948, the Jews set up the republic of Israel. The Arabs refused to accept partition and launched a war against the new state (*see* Israel). Jerusalem became a battleground. When the war ended, Israeli troops held the modern city and Jordan's Arab force held the Old City. In December 1949, the United Nations voted again to internationalize Jerusalem. Israel and Jordan refused to accept its decision. In 1950 Jordan annexed its part of Jerusalem and Israel moved some of its government offices to the new city in Jerusalem. Population (1950 est.), 120,000.

WHERE JESUS CARRIED THE CROSS

Along this Way of Sorrows (in Latin, Via Dolorosa) according to tradition, Jesus carried the cross as He went to His death.

"SALVATOR MUNDI"—*The Story of Jesus*

Christians call Jesus the Saviour or *Salvator mundi* (Latin for "Savior of the World"). This painting by Heinrich Hofmann, known as 'Christ in the Temple', illustrates a well-known passage from the New Testament: "And when they had fulfilled the days, as they returned, the child Jesus tarried behind in Jerusalem; and Joseph and his mother knew not of it. And it came to pass ... that after three days they found him in the Temple in the midst of the Doctors, both hearing them and asking them questions. And all that heard him were astonished at his understanding and answers."

JESUS CHRIST. Nearly all that we know about the life of the founder of Christianity is contained in the four Gospels of the New Testament. These accounts were written from 60 to 100 or more years after the birth of Christ, by men of different temperaments. So they naturally differ in some details, but they agree in all essentials. But aside from mere mention by two Roman historians, in works written within a century after his death, the secular historians of his time said nothing about this Man who has had such a profound influence on the life and thought of the world.

Although in most countries today time is reckoned from the birth of the founder of Christianity, a mistake occurred in fixing the date of this event. We have no record of the exact date of Jesus' birth. But we do know that the date adopted several centuries later as the beginning of the Christian Era was at least three years too late; that is, Jesus was born in 3 B.C., or earlier, according to our reckoning.

Jesus was born in Bethlehem of Judea, about six miles from Jerusalem. To his mother Mary an angel foretold that she, a virgin, should bring forth a child who should be the Son of God. When her time was fulfilled Mary and her husband Joseph, a poor carpenter from Nazareth in the northern province of Galilee, went to Bethlehem to be taxed by the Roman governor. Because there was no room for them in the inn they had to lodge in a cave hollowed in a hillside and used as a stable. Yet the babe born in this lowly place was descended from David, the great king of Israel; and his birth was heralded by signs and wonders. Guided by the songs of angels, shepherds came to the cave and knelt in adoration before the holy child lying in swaddling clothes in a manger.

Soon afterward wise men, or "Magi," as they were called, came from the East, saying, "Where is he that is born King of the Jews? for we have seen his star in the East, and are come to worship him." The chief priests of Herod, king of Jerusalem, said the child would be found in Bethlehem. The Magi continued their journey, with the bright star—now traditionally called the Star of Bethlehem—moving ahead of them till it stopped above the place where the child lay.

Herod feared his throne would be endangered by the child if he grew to manhood. To remove the threat, Herod ordered all children two years old or younger

to be slain. But Joseph, having been warned by an angel in a dream, fled with Mary and the child to Egypt, where they lived until the cruel Herod died. Then they returned and took up their abode in Nazareth, where Jesus passed his boyhood. Of these years, the Bible tells us only one incident. When he was 12 years old, Jesus went with his parents to Jerusalem, as was the custom, to celebrate the Passover. Returning home, his parents had traveled a long distance when they noticed that Jesus was not with them. Anxiously returning to the Temple, they found him sitting in the midst of the doctors, who were astonished by his understanding and wisdom.

From boyhood to manhood Jesus grew in strength and wisdom. When he was about 30 years of age, he was ready for his great mission. A short time before, a prophet had appeared, announcing the near approach of the long-awaited Messiah or Christ, and calling to the people to repent and prepare for the kingdom of God. From the fact that he baptized his followers in the River Jordan, he is known as John the Baptist. Jesus himself came for baptism, and John recognized in him the one mightier than himself, whose coming he foretold.

Preparation for His Great Work

In order to prepare himself for the great work that now lay before him, Jesus went alone into the wilderness, and for 40 days and 40 nights he fasted and prayed, struggling with temptation. After his return there gathered about him a little group of disciples who recognized him as the Messiah. Gradually the numbers of these followers increased, and from them were chosen the 12 apostles who were especially appointed to spread his message (*see* Apostles).

Jesus showed miraculous powers in turning water into wine at the wedding at Cana, in healing the sick, in feeding 5,000 with five loaves and two fishes, and in performing many other wonders. Wherever he went he sought out the lowly, associating with publicans (the despised tax-gatherers), with the poor and the maimed, even sinners. To all who were suffering he brought a message of comfort: "Come unto me, all ye that labour and are heavy laden, and I will give you rest." Love was the keynote of his preaching. "Thou shalt love the Lord thy God with all thy heart, and with all thy soul, and with all thy mind, and with all thy strength; this is the first commandment. And the second is like, namely this, Thou shalt love thy neighbour as thyself." He even taught, "Love your enemies, do good to them which hate you." He bade men follow the law of Moses and the words of the prophets. "Think not I come to destroy the law, or the prophets," he said; "I am not come to destroy, but to fulfil." But he saw that many of the Pharisees, who boasted of their strict adherence to the Jewish law, followed only the letter of the commandments, and forgot the spirit. For this he did not hesitate to denounce them; while they in turn looked upon him as a revolutionary, accused him of breaking the Sabbath because he healed the sick on the day of rest, and regarded as blasphemy his claim to be the Son of God.

When Jesus at last went to Jerusalem he had long known that he must suffer and die. On Passover Eve, he ate his last supper with his 12 disciples and retired for prayer to the Garden of Gethsemane. There he was betrayed by Judas Iscariot, one of the Twelve. He was arrested, and brought before the Sanhedrin, the Jewish council of priests and elders. After a hasty trial, they pronounced him "guilty of death" for blasphemy; but as they had no authority to pass the death sentence, they delivered him up to Pontius Pilate, the Roman governor. Pilate, after washing his hands to show that he was innocent of the blood of the prisoner, yielded to the demands of the multitude and gave him up to be crucified. With a crown of thorns upon his head and arrayed in a purple robe, which the soldiers placed upon him in mockery, Jesus was led to Golgotha, the place of execution. There, with a criminal on either side of him suffering the same punishment, he died upon the cross, crying in his last agony, "My God, my God, why hast thou forsaken me?"

Jesus' body was taken from the cross and placed in a tomb by Joseph of Arimathea and Nicodemus. Three days later, on the first day of the week, when some of the women came with spices to embalm the body, they found the tomb empty. An angel who kept watch told them that Christ had arisen from the dead. The risen Christ appeared first to Mary Magdalene, the once sinful woman from whom Jesus had cast out seven devils, and who had become one of the most devoted of his followers; and then to others who had been close to him. He spent 40 days on earth after his resurrection, and then from the midst of his disciples he was taken up to heaven. He left no writings. But from recollections of his teachings his followers later put together the record of his ministry, as we have it in the New Testament, and with it there slowly took shape the doctrine and organization of the Christian church, which has come to be one of the ruling forces in the world's history. (*See* Church, Christian.)

JET PROPULSION. Anyone who has dropped a garden hose when the water is turned on to full strength and has watched it squirm about on the ground has seen jet propulsion at work. The same pressure that drives the water out of the nozzle pushes back on the hose. So, when the hose is free to move, it backs away from the water jet as best it can.

The principle can be understood even more clearly from an explosion in a box, as the accompanying pictures show. The important fact to remember is that a liquid or a gas confined under pressure pushes out in all directions against its container. The push in one direction tends always to be offset or balanced by an equal push in the opposite direction. But when the gas or liquid escapes through an opening, the push at that point ceases, and the opposite push can now move the container. Thus, in jet propulsion, it

is the reaction from the jet and not the jet itself that provides the driving force. For this reason, engines using the jet principle are often called "reaction motors." We see, then, that it is incorrect to say that a jet does its work by pushing against the outside air. Indeed, jet laboratory experiments generally work better in a vacuum.

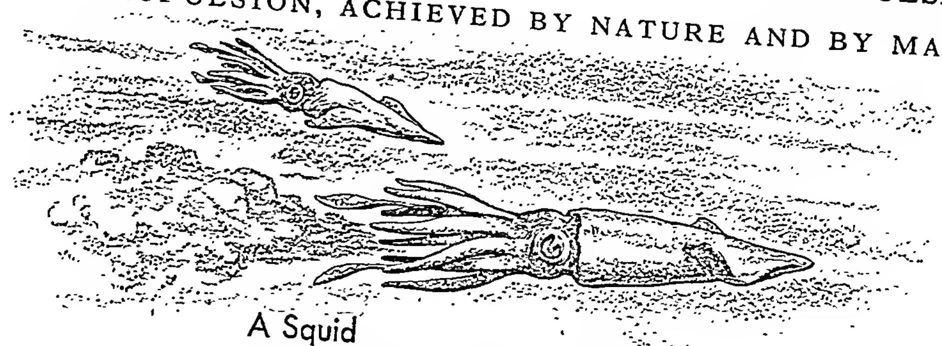
The principle of jet propulsion obeys Newton's third law of motion: for every action there is an equal and opposite reaction (*see* Mechanics). The jet principle has been used for centuries in rockets and fireworks, and for many years in reaction turbines (*see* Fireworks; Rockets; Turbines). But it took the urgent demands of the second World War to bring it into use for driving airplanes, flying bombs, and rocket shells.

Types of Reaction Motors

Jet devices for long-range flight need a large supply of fuel and quantities of oxygen to burn it. Almost any concentrated fuel may be used. Common ones are various petroleum fractions and solid fuels such as gunpowder.

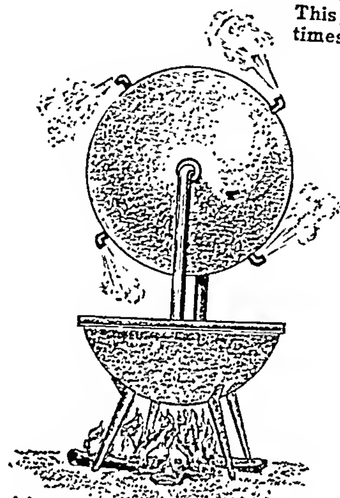
Reaction motors differ in the means used for oxygen supply. The *chemical fuel* types (rocket engines) may use solid fuels like gunpowder. These contain in themselves the oxygen needed for combustion (*see* Explosives). Others may carry a supply of liquid oxygen which is mixed with various liquid fuels as needed. This fueling method was used in the German V-2 bomb in the second World War, and in various rockets developed by the United States after the war. One notable rocket engine was the United States Army Air Forces' XS-1. It could generate 6,000 pounds of thrust (push) in less than two seconds. It used ethyl alcohol and liquid oxygen for fuel. The weight of the

JET PROPULSION, ACHIEVED BY NATURE AND BY MAN



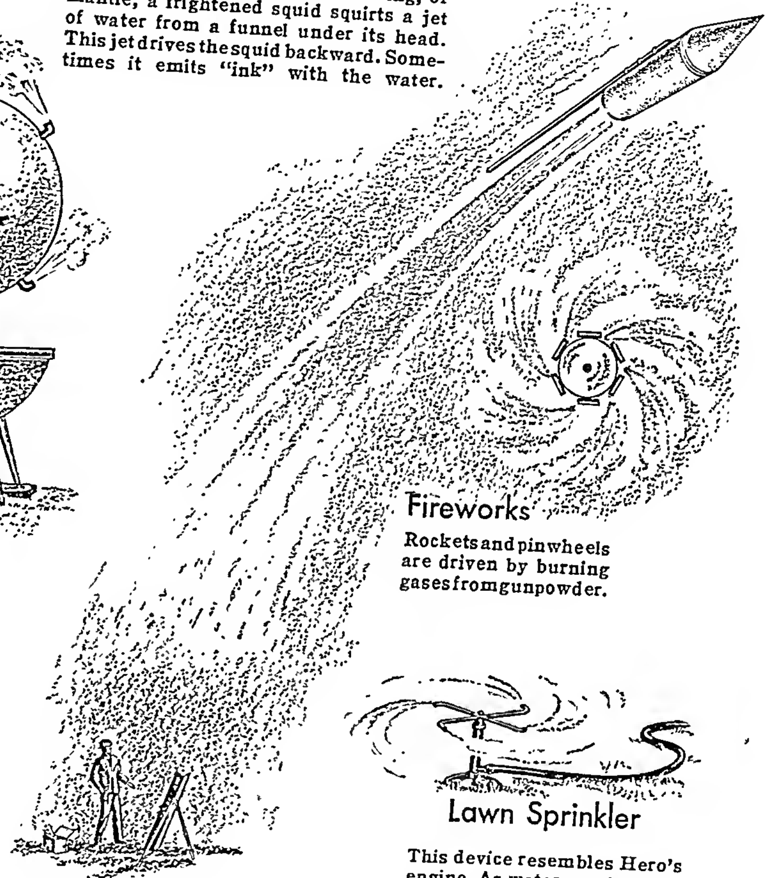
A Squid

By contracting its muscular covering, or mantle, a frightened squid squirts a jet of water from a funnel under its head. This jet drives the squid backward. Sometimes it emits "ink" with the water.



Hero's Steam Engine

In this ancient device a metal ball was free to spin and was supplied with steam from a boiler through the supports. The reaction from the escaping jets kept the ball spinning.



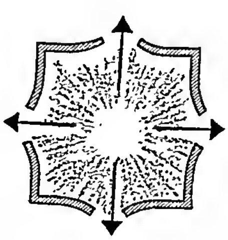
Fireworks

Rocketsandpinwheels are driven by burning gasesfromgunpowder.

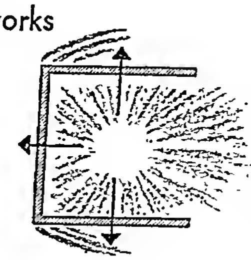
Lawn Sprinkler

This device resembles Hero's engine. As water spurts out of the four bent nozzles the sprinkler head revolves.

Why a jet works

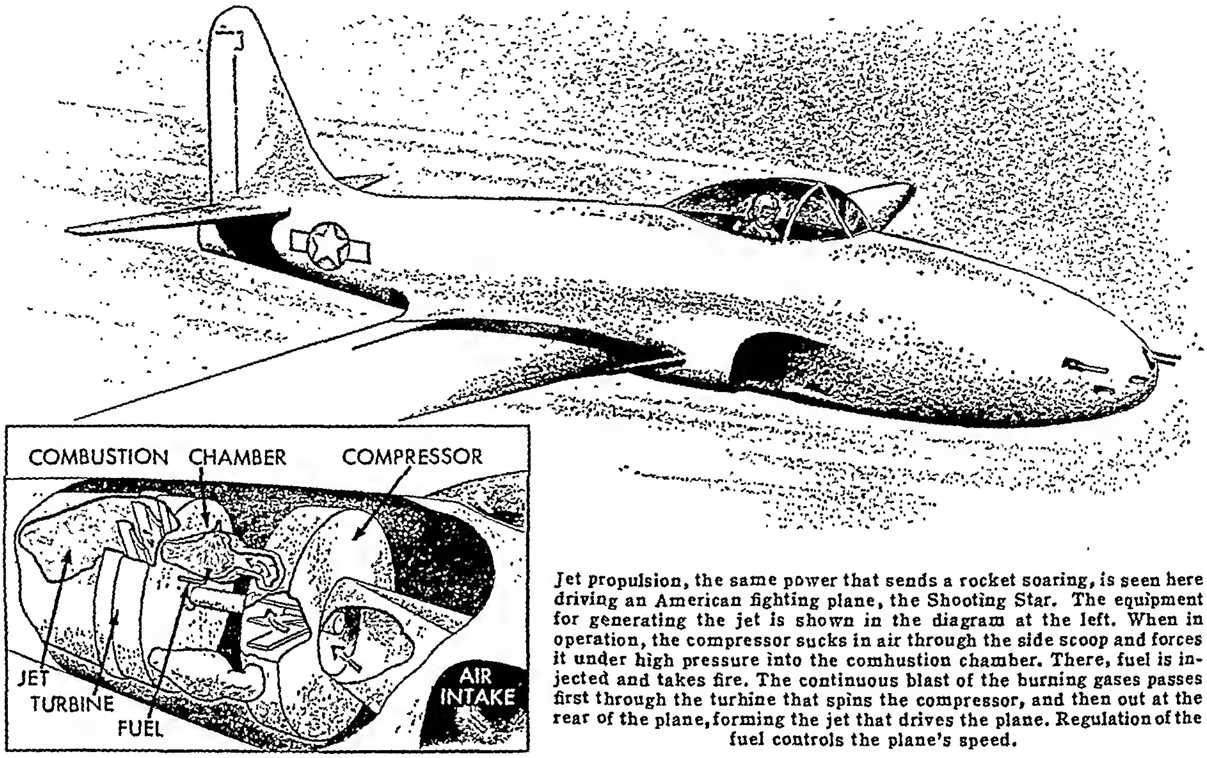


In a closed box an explosion presses equally against all sides. It may burst out, but the gas pressure does not tend to push the box in one direction more than another.



In an open box the action of the gas is no longer balanced. On the open side it escapes; on the side opposite it pushes as before. Therefore the box is driven in that direction.

ROCKET-LIKE JET PLANE, BORN OF WARTIME NEED



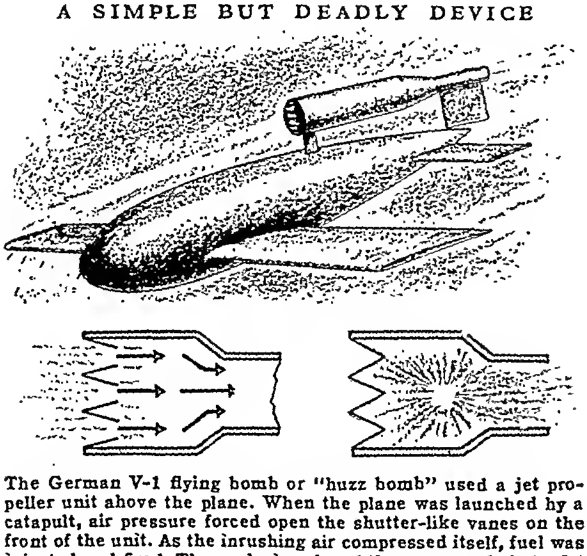
Jet propulsion, the same power that sends a rocket soaring, is seen here driving an American fighting plane, the Shooting Star. The equipment for generating the jet is shown in the diagram at the left. When in operation, the compressor sucks in air through the side scoop and forces it under high pressure into the combustion chamber. There, fuel is injected and takes fire. The continuous blast of the burning gases passes first through the turbine that spins the compressor, and then out at the rear of the plane, forming the jet that drives the plane. Regulation of the fuel controls the plane's speed.

additional oxygen limits the range and duration of flight. Hence devices driven by rocket engines are limited to swift but relatively short flights.

Most jet engines are of the *airstream* or *thermal air* type. Either name means that the engine gets its oxygen from the atmosphere. The simplest example of the type is the *continuous duct* or *ram* motor, sometimes called the *athodyd* (from letters in the words "aero-thermo-dynamic duct"). This motor resembles a long barrel with both ends knocked out. Air rushes in from the front and mixes with fuel which is sprayed from orifices in the middle of the duct. The mixture is ignited, and the burning gases expand and blast out to the rear. They cannot escape forward because they are compressed or rammed back by the incoming air.

The *intermittent duct* type has a mechanical trap. The trap closes to prevent the burning gases from escaping forward and opens to admit air when the gases are exhausted. This type was used on the German V-1 "buzz bomb" pictured below. Each type of duct motors must be moving fast before it gets air under sufficient pressure to work. Planes and other devices that use them must be launched by catapult, attached rockets, or a large "mother" airplane.

A SIMPLE BUT DEADLY DEVICE



The German V-1 flying bomb or "buzz bomb" used a jet propeller unit above the plane. When the plane was launched by a catapult, air pressure forced open the shutter-like vanes on the front of the unit. As the inrushing air compressed itself, fuel was injected and fired. The explosion closed the vanes and shot a jet rearward. When the gas was spent, the vanes opened and the process was repeated, causing an intermittent series of jets.

The Gas Turbine Engine

To fly at moderate speeds necessary for take-offs and landings, a jet-propelled plane must have some means of compressing air from the atmosphere to the pressures needed for burning fuel efficiently. Most jet aircraft engines have a *gas turbine* to provide power for the compressor. These engines are called *turbo-jets.* The turbine is placed behind the combustion chamber and takes power from the same gas that later emerges as the jet. A shaft runs forward from the turbine through the combustion chamber to drive the compressor. The rest of the gas then passes out to the rear.

Turbo-jet engines use a blend of gasoline, kerosene, and Diesel oil. This fuel has good heat energy, is stable at extreme temperatures, ignites swiftly, and burns without excessive carbon and gum deposits. The compressor feeds air in at extremely

high pressures and the fuels burn completely, leaving little carbon or exhaust at cruising speeds.

Uses for Turbo-Jet Engines

Turbo-jet engines have been installed experimentally in a British automobile, but their principal use is for driving aircraft at speeds from 400 to 700 miles an hour. They are not suitable for planes designed for slower speeds. To make the most efficient use of the jet, the plane must move forward about as fast as the propelling gas moves backward. The engine operates best at high altitudes where the cold, rarefied air offers little head resistance. This is precisely where the propellers of the conventional aircraft begin to lose efficiency for lack of enough air to "bite on."

Armies and navies are equipping nearly every type of combat plane with turbo-jet engines. Even such radical designs as the "flying wing" and the "pancake" do their best work with these engines (*see* Airplane). Some of the huge bombers carry a small turbo-jet escort plane in their bellies, to be launched when attacked.

Commercial airliner designs favor combining turbo-jet engines with conventional reciprocating engines. Both types work in take-offs and climbs, and the turbo-jets take over for cruising at high altitudes. Reciprocating engines are being retained on passenger and cargo planes that make short runs with many stops.

Details of Turbo-Jet Operation

Different methods of compressing air and forcing it into the combustion chamber distinguish the various designs of turbo-jet engines. One method uses a *centrifugal compressor*. Air enters through screens surrounding the engine and passes into the compressor. The compressor blades throw the air outward into channels leading to parallel combustion chambers. This arrangement leads to a wide, stubby engine design, suitable for installation behind the cockpit of the Shooting Star shown on the previous page.

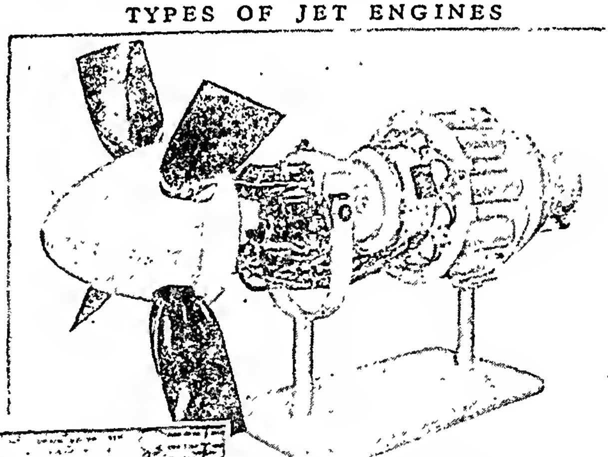
Another method uses an *axial-flow compressor*. Air enters at the nose, passes back through at least eleven stages of compression, and finally goes to the combustion chamber. This sequence of engine operations leads to a long, slim design that can be installed in streamlined wing nacelles. Most large planes use the axial-flow type.

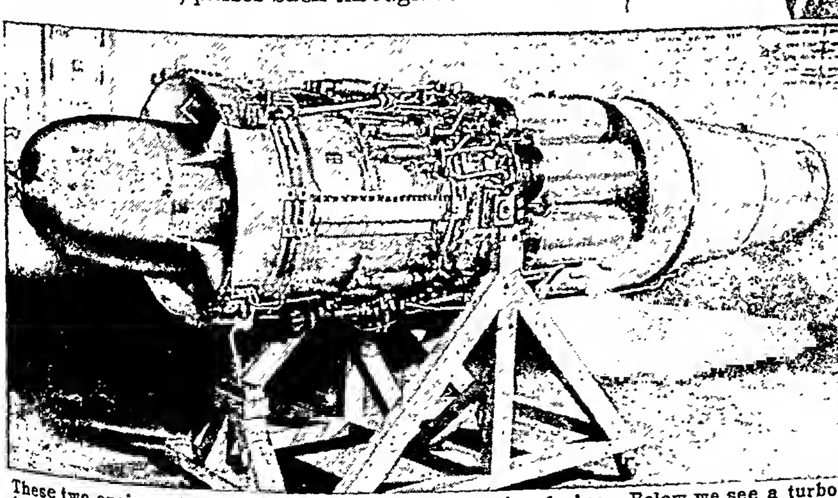
An outgrowth of both the centrifugal and the axial-flow compressor engine is the gas turbine propeller or *turbo-prop* engine. Here part of the power developed by the turbine goes to turn a propeller. This type is more efficient at lower speeds than the turbo-jet. Planes with

READYING JET ENGINES FOR FLIGHT

Many large jet planes carry their engines in wing nacelles, leaving the complete fuselage free for load carrying. Here we see a mechanic checking an axial-flow jet engine through an open nacelle. The plane is a four-engine Air Force B-45 bomber, with twin engines in each nacelle.

TYPES OF JET ENGINES





These two engines show different principles of jet engine design. Below we see a turbo-jet type that pushes a plane with power from its escaping gas jet. It drives planes at speeds of more than 600 miles an hour. The second engine is a gas turbine design that sends some of its jet to push the plane and the rest to turn a propeller. It is used to drive planes with speeds of 400 to 500 miles an hour.

turbo-prop engines burn less fuel and are better suited for circling while waiting to land at crowded airports.

Rapid Development of Jet Propulsion

Although the general principle of jet propulsion had been evolving for many decades, it was not applied to aircraft engines until Frank Whittle of Great Britain took out basic patents in the 1930's. Whittle began work in 1928 as an R.A.F. air cadet. His designs were studied in Germany and Italy, and the first plane to fly with a jet engine was an Italian Caproni-Campini. It flew from Milan to Rome at a speed of 130 miles an hour. Whittle's designs were of the centrifugal type, but these were modified by the Germans to axial-flow.

The first jet fighters in the second World War were German Messerschmitt and Heinkel planes with axial-flow engines. The Allies soon counterattacked with their first jet fighter, a British Gloster Meteor. This plane was used to track and shoot down German buzz bombs over England.

Jet engines for American combat planes at first were based upon the Whittle design. Development was entrusted largely to American electrical engineering firms to utilize their previous experience with gas turbines for electric power.

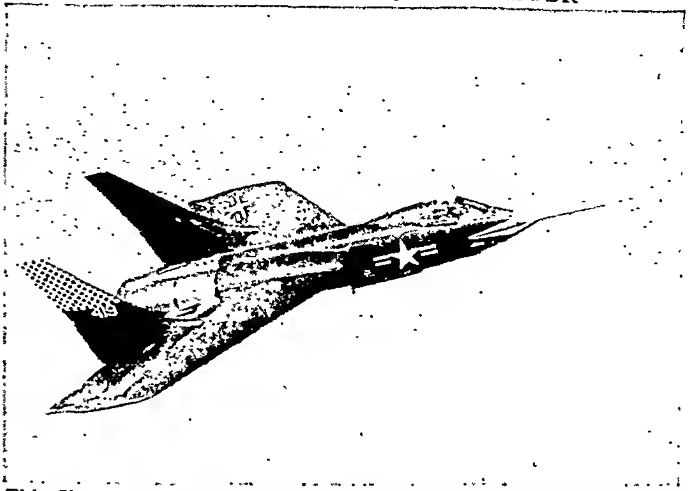
These first centrifugal engines were installed in the P-59A Airacomet and in the P-80 Shooting Star. American engineers developed (independent of the German designs) an axial-flow engine. It was first used as a booster engine on the Navy Corsair and later on the Navy Phantom. Both types saw little actual combat but they helped maintain American leadership in postwar flying.

Another war development of the jet-propulsion principle was JATO —a name coined from the words "jet-assisted take-off." This was a simple jet device fastened to the fuselage of planes with conventional engines. It was originally designed to help planes with heavy loads to take off from carrier flight decks. Later it was used to assist take-offs from short land runways. It was especially valuable when large planes made emergency landings in very small fields. JATO "bottles" could be easily attached and the plane could gather air speed in a short distance. It also found limited use on jet planes for even swifter take-offs. JATO was developed by Dr. Theodor von Kármán and a group of physicists at the California Institute of Technology.

Postwar Research

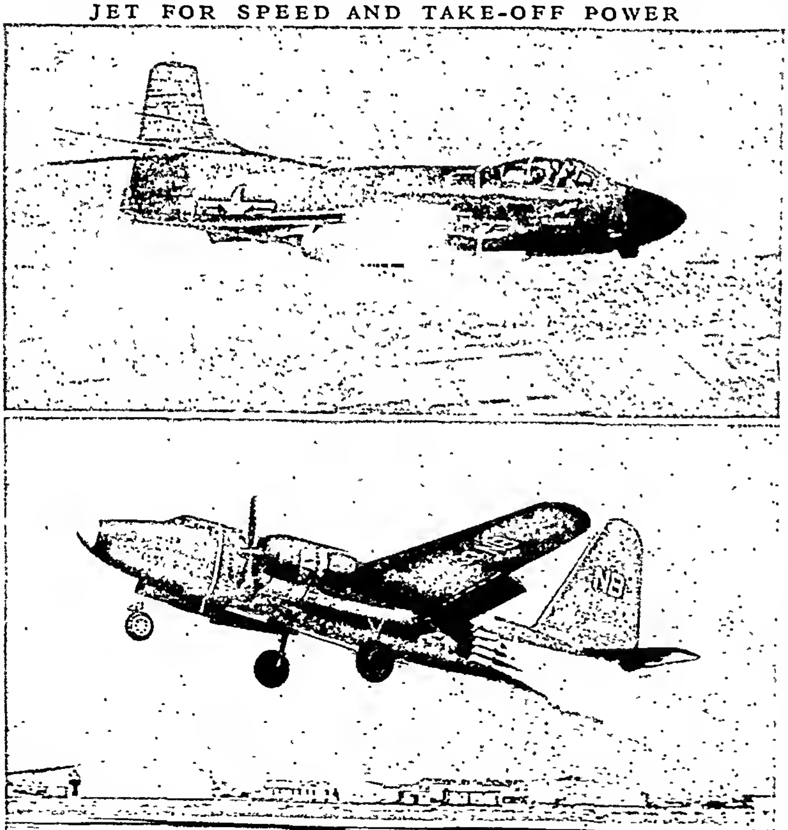
After the second World War jet-propulsion theory was firmly established. But designers faced many problems in building engines and air frames. Jet engines could develop

A CARRIER-BASED JET FIGHTER



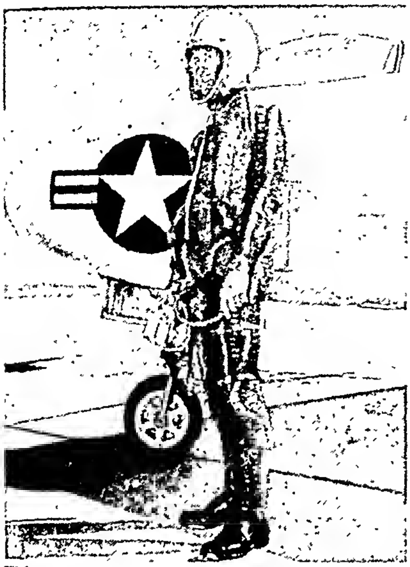
This Chance-Vought Cutlass is one of the Navy's swiftest fighters. It has no tail; vertical stabilizers and rudders are located on the trailing edge of the wing. Two turbojet engines with afterburners provide power.

JET FOR SPEED AND TAKE-OFF POWER

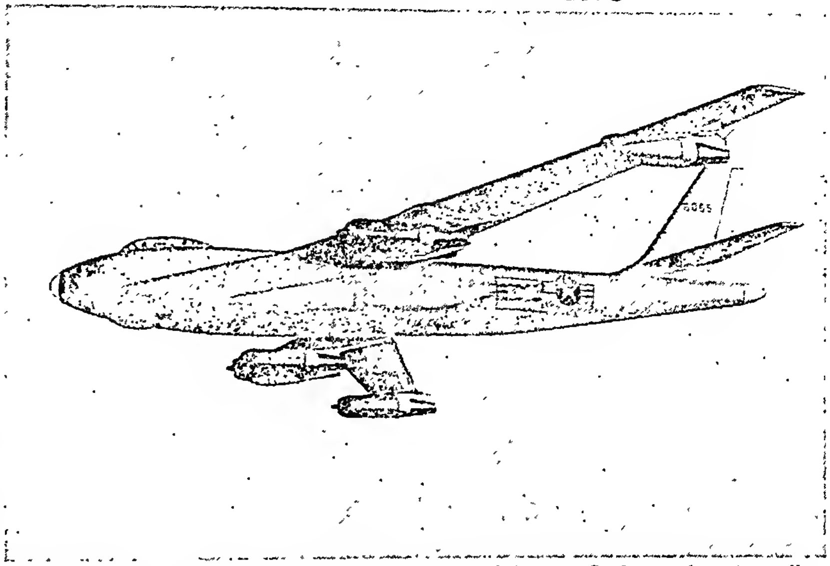


These two Navy planes use jet power for different purposes. At the top, a Douglas Skyknight has twin jet engines for all power requirements. The plane is a carrier-based night fighter with radar search and gunnery equipment. The bottom picture shows a Neptune patrol bomber, using JATO (jet-assisted take-off). The JATO works with the reciprocating engines to help the plane gather air speed.

FOR HIGH ALTITUDE FIGHTING AND BOMBING



This Air Force pilot (left) wears a high altitude pressure suit. It inflates automatically if his jet plane cockpit loses pressure.



The B-47 Stratojet bomber (right) can fly faster than 600 miles an hour. It has six jet engines and carries a ten-ton bomb load.

sufficient power to carry planes beyond the transonic barrier, but full consumption was high. A special mixture of petroleum fractions, called JP-3, proved efficient. Other fuel experiments centered on powdered metals, especially aluminum and magnesium compounds. To withstand heat, engine tubes were lined with ceramic coatings.

Another new feature was the *afterburner*, used for extra power during take-offs and for added bursts of speed during combat. The device injected fuel directly into the tailpipe. The intense heat and pressure burned it instantly and gave extra pounds of thrust.

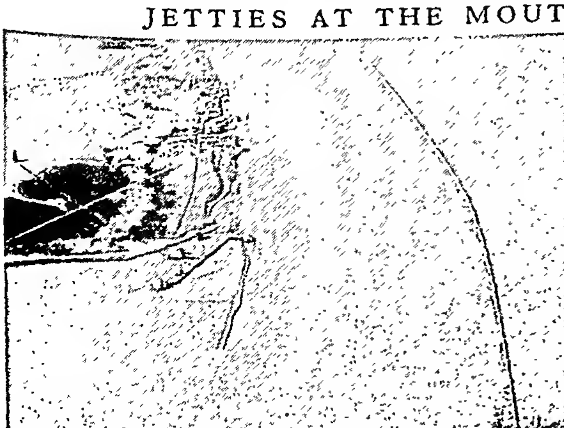
In airfoil design, the swept-back wing was favored, and radical triangle shapes were tried. For landing and take-off at subsonic speeds, swept-back wings are unstable. Most successful models were compromises between the swept-back and straight types.

Refrigerating systems partially solved the problem of the heat generated by friction with air. Higher cruising altitudes, where air offers less resistance and less heat is generated, were sought. Conventional navigation methods were useless at supersonic speeds, and automatic devices for taking star "fixes" and computing courses were developed.

Jetty. Embankments or piers built in rivers or harbors to increase the water's depth are called jetties. They work by narrowing the channel and thus increase the scouring action of the current. Jetties are particularly valuable where a river enters a sea that has little tidal movement. There the river continuously deposits sediment at the mouth, and the absence of tide allows the mud to form a delta.

One type of jetty is built of high openwork patterns of braced timber, steel, or concrete. Another type is low and solid, made of stone or concrete. Jetties at the mouth of the Danube River, built from 1858 to 1868, increased the water's depth from 9½ feet to 22 feet. The Mississippi River jetties, built in 1875-79, by James B. Eads, were great engineering feats. They were strong containing walls, made by sinking mattresses of interwoven osiers and covering them with stone and concrete.

JETTIES AT THE MOUTHS OF THE MISSISSIPPI



The long line in the picture above is the jetty along the South Pass of the Mississippi River in the delta at the Gulf of Mexico.

Another jetty, the arching line at the right, speeds up the current of the Southwest Pass, preventing deposits of mud in the channels.

JEWELRY—
for "MAGIC"
and for ADORNMENT

JEWELRY AND GEMS. Men, women, and children in every part of the world wear some sort of jewelry either as ornament or for "magic." Some pieces, made of gems and precious metals, are almost priceless. Much, however, is only *costume jewelry*—fashioned from imitation gems and the cheaper metals and manufactured in large quantities. Among primitive peoples, as in Africa and on the Pacific Islands, jewelry is largely oddments of wood, bones, shells, or animal hair; yet many of the designs are graceful. For some tribes "jewelry" is only a wooden lip plug.

As far back as the Old Stone Age, men made jewelry. In their cave dwellings they fashioned amulets and necklaces of teeth and animal bones to ward off evil spirits. By Babylonian times, men learned to work with gold, and jewelry making became a craft. Babylonian jewelers worked within the temple grounds. Jewelers in ancient Egypt developed jewelry enamels and produced magnificent gold and silver pieces. The Etruscans have never been equaled for their work in granulation—fusing tiny pellets of gold onto a metal surface to form a raised design. (For picture, *see* Egypt, Ancient.)

The ancient Greeks worked chiefly in enamel and *filigree*—gold or silver wire shaped into lacelike openwork. Jewelers of the Roman Empire added gems to gold and silver pieces. Enameling and heavy design characterized the elaborate Byzantine jewelry.

In ancient Hebrew times, bracelets were the insignia of kings. The Bible frequently mentions jewelry. The design for the breastpiece of Aaron, the high priest, for example, appears in Exod. xxviii, 15, and was to have 12 gems—sardius (ruby), topaz, carbuncle, emerald, sapphire, diamond, jacinth, agate, amethyst, beryl, onyx, and jasper, all set in gold filigree.

Medieval nobles delighted in jeweled religious objects, and in robes and gloves sewn thick with gems (for picture, *see* Charlemagne). In the brilliant, florid days of the Renaissance, jewelry designs were made by such great artists as Dürer in Germany and Botticelli, Ghiberti, and Cellini in Italy.

Except in Japan, peoples of the Orient have long loved jewelry and worn a great deal of it. In the bazaars of India today artisans still make pieces from designs that may be 2,000 years old. The Chinese too display great skill and artistry, especially in the classical wedding headdresses. Chinese so prize jade that many carry a piece of it in their pocket to stroke.

Medieval artists carved this superb medallion from rock crystal, probably for Lothair II, king of Lorraine. It depicts the story of Susannah and is now in the British Museum.

Instead of the brilliant green jade, they prefer more rare colors, such as white mottled with grass green or red spots and green flecked with gold.

Gem Superstitions and Gem Materials

Superstition surrounds some gems. As late as the 18th century many people used powdered gems to "prevent" or "cure" disease. They thought sapphire would relieve insanity, powdered jet would kill toothache, and topaz ease asthma. Even today some superstitious people wear amber beads to "cure" goiter; others fear that opals bring bad luck.

Most gem stones are hard minerals. They are valued for their rarity and pleasing appearance. Their colors range from the colorless transparency of diamonds to pure black. Some are mottled or banded. Others reflect light waves in sparkling brilliance.

Gem minerals are usually crystal. Mineral crystals vary in size from huge blocks weighing many tons to tiny specks that can be seen only under a microscope. Rock crystal, a common gem material, is found in chunks large enough to be carved into massive vases and plates. The crystals of chalcedony are so tiny that this mineral was long thought to be noncrystalline. Minerals such as chalcedony are called *cryptocrystalline* (Greek for "hidden crystal"). A very few gem materials, including opal and turquoise, seem to be *amorphous* (Greek for "without form").

A few gem materials are organic substances or have an animal or vegetable origin. The pearl, for example, is formed from secretions of mollusks. The pearls of great value come only from the pearl oyster (*see* Pearls). Amber is a fossilized tree resin; jet, a compact form of lignite (brown coal); and coral, the skeletons of tiny sea animals (*see* Amber; Coral).

COSTLY GEMS IN SIMPLE DESIGN

The platinum setting of this emerald and diamond necklace is simple, emphasizing the beauty of the stones. It is set with seven emeralds in graduated sizes, with baguette diamonds all around.

There are also *manufactured* gems. Early in the 19th century several experimenters successfully produced artificial reproductions of rare stones, such as the ruby. In 1902 Auguste Verneuil of Paris established the first commercially successful process for making such *synthetic* gems. The chief raw material is extremely pure, powdered aluminum. This is sifted through an intense oxyhydrogen flame, and the fused material drops down on a sticklike support. A lump (*boule*) is gradually built up, cooled, and cut.

Pure alumina yields white sapphire. Mixed with a small amount of chromium oxide, it makes synthetic ruby. Other mixtures yield blue, green, rose, or violet sapphires. A variation of the Verneuil process, developed in the United States in World War II, produces slender rods up to 30 inches long. They are especially useful in the manufacture of jeweled bearings for precision instruments. Most synthetic gems are used in industry.

Imitation Gems, Doublets, and Gem Cutting

Chemically, synthetic gems and natural gems are identical. An expert, however, can tell a synthetic gem by physical differences. The thin layers formed by the material as it builds into a boule may be seen under a microscope. Gas bubbles are sometimes found in synthetic gems, whereas natural gems may have bubbles of liquid.

Other manufactured types are *imitation* gems and *doublets*. For transparent imitation gems—such as ruby, diamond, or sapphire—glass is used. It is a very hard variety called *paste*, or *strass*—giving the name "paste" to imitation gems. A real gem can also be combined with less valuable material. A thin slice of ruby, for example, may be cemented to a base of red paste or of garnet. The ruby forms the top of the cut stone and the combination is a *doublet.*

The beauty of all gems is increased by cutting and polishing. In ancient times and in the Middle Ages, stones were merely smoothed and rounded. From this treatment developed the *cabochon cut* of today. Stones cut *en cabochon* are oval or round in outline and have a polished, domed surface. The bottom is usually flat.

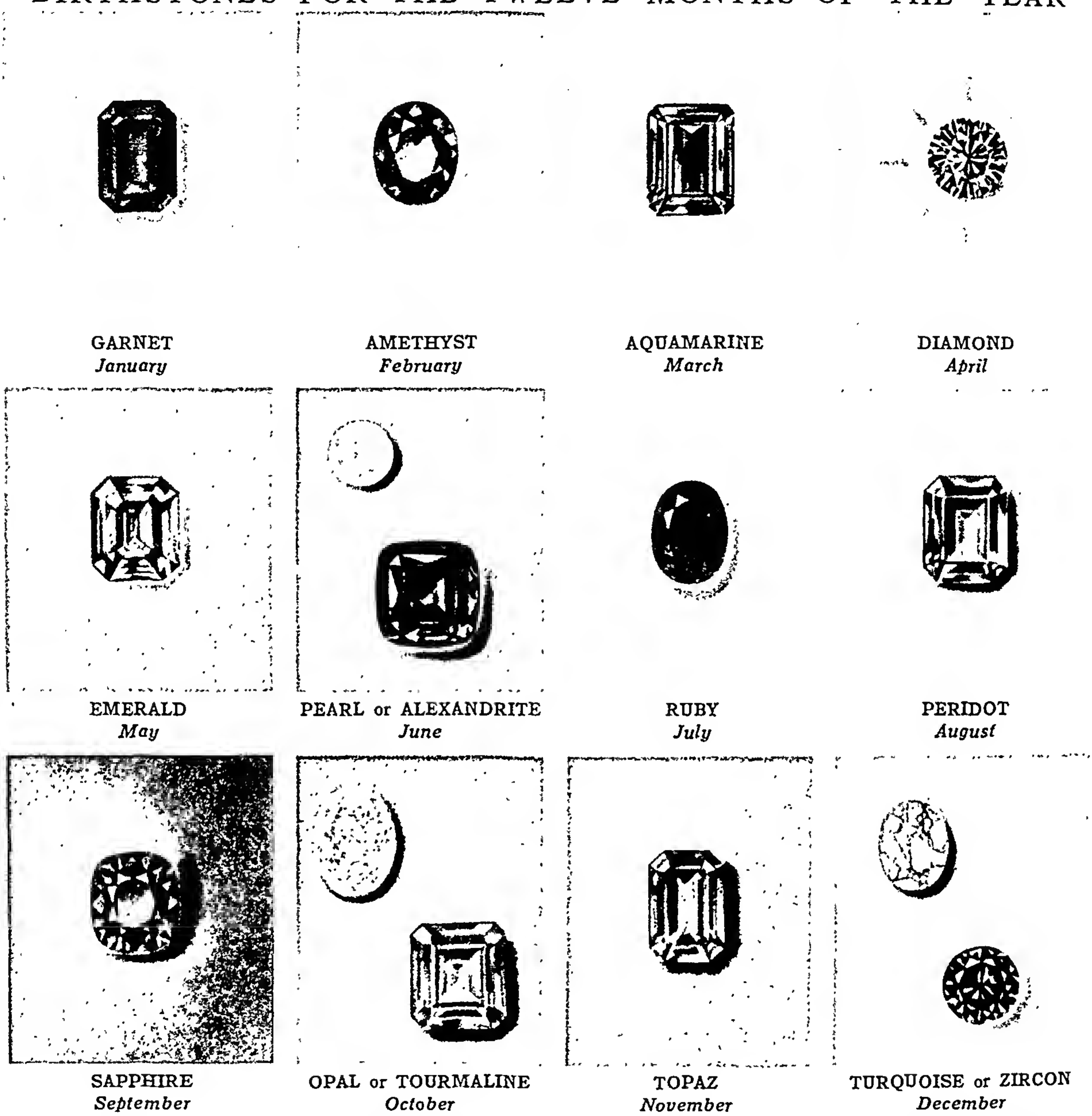
In the late Middle Ages or early Renaissance, men discovered the art of cutting stones in a complex of flat surfaces, or *facets*. Earliest was the *table cut*. This was a simple pattern with a rectangular principal face, or *table*, on top, surrounded by four sloping quadrilateral facets. The base facet, the *culet*, was much smaller than the table. Typical modern cuts are shown later in this article.

The diamond's hardness makes it an extremely difficult gem to cut, and diamond cutting is a specialized craft in the gem-cutting industry (*see* Diamond). Cutters of other gems (also called *lapidaries*) use a sandstone or carborundum grindstone. For faceted cuts the grindstone is flat surfaced; for cabochon cuts, it

THE "CROWN OF ENGLAND" AND EMBLEMS OF RULE

The coronation crown of England is St. Edward's crown. Almost priceless, it is studded with diamonds, rubies, sapphires, emeralds, and pearls. Shown with it here are the orb, the scepters with dove and cross; and the coronation ring.

BIRTHSTONES FOR THE TWELVE MONTHS OF THE YEAR



Traditions and superstitions about the various gem stones have led to assigning certain of them to each of the 12 months. These stones are popular birthday gifts. Because superstition associates pearls with tears and opals with bad luck, alternate stones are assigned those months. The popularity of zircon in recent years has led to its wide use as a December birthstone.

is grooved. While grinding, some lapidaries hold the gem in their fingers; others use a lapidary's stick (*dop*), to which the gem is cemented. They polish the gems by holding them against a canvas-covered wheel, impregnated with *jeweler's rouge*, ferric oxide.

Jewelry making is a popular hobby. Gem materials and cutting equipment are available in most large cities; and many organizations, such as the Y. M. C. A., give courses in gem cutting and jewelry making. The science of gems is called *gemmology* or *gemology*.

Gem stones were formerly classed as *precious*, *semi-precious*, and *ornamental* stones. Today this classification is largely replaced by the broader term *gem materials*. The following list includes the major gem materials and some of the less important ones.

Achroite. A colorless variety of tourmaline.

Agate. A type of chalcedony, with colored bands, first found on the banks of the river Achates; hence the name agate. The markings of moss agates occasionally resemble natural objects and so were much prized in the past. Most agates are naturally grayish and are artificially colored. They are usually soaked in solutions of sugar or honey and acid or salt solutions and then heated.

Alexandrite. Named after Alexander II of Russia. A variety of chrysoberyl, grass green in color. Shows a red hue in artificial light.

Amazonite. A feldspar, jadelike in color. Found in Ural Mountains, Pennsylvania, Virginia, Colorado (Pikes Peak).

Amethyst. A transparent violet or purple quartz. Found in Brazil, Uruguay, Siberia, Ceylon, India, Madagascar, Iran, Mexico, Maine, New Hampshire, North Carolina, Pennsylvania, and Lake Superior region. Worn by ancient Romans to "prevent" intoxication; many wineglasses made from it in days of ancient Rome. Color of some amethysts improved by treating with heat; others become yellow, then colorless, under heat.

Aquamarine. Transparent sea-blue or sea-green beryl; of the same family as the emerald but far less valuable. Found on Isle of Elba, Madagascar, Ireland, Ural Mountains, Colorado, California, Connecticut, North Carolina, Brazil, Ceylon, India. One aquamarine crystal from Brazil weighed 243 pounds.

Aventurine. A quartz spangled with yellow mica or other mineral. Also called goldstone.

Azurite. An azure-blue copper carbonate found in most copper mines. Pliny called it *caeruleum* ("like the sky"). Used for tabletops and vases. Found in Ural Mountains, Rhodesia, Chile, Belgian Congo, Arizona, Australia.

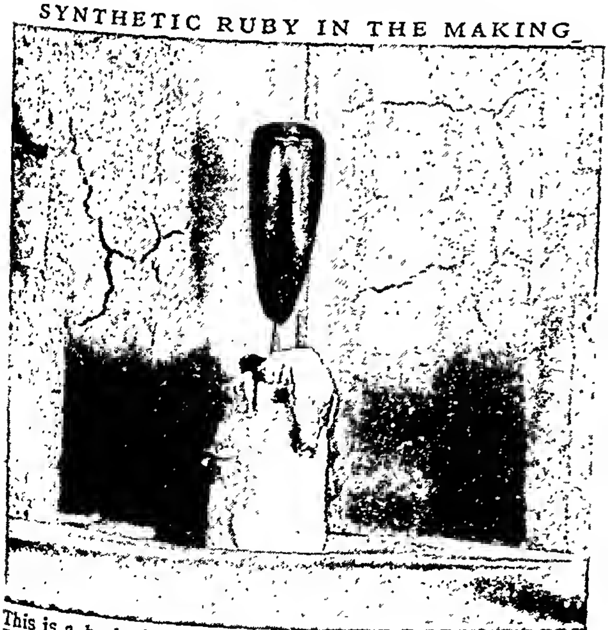
Beryl. A silicate occurring in several forms. Includes the emerald, aquamarine, golden beryl, morganite, and goshenite.

Bloodstone, or Heliotrope. A dark-green chalcedony (quartz) spotted with red jasper. Prized in the Middle Ages for carvings of martyrs, with the red flecks representing blood spots. Was called "St. Stephen's Stone." Now widely used in rings. Found in Siberia, India, Hebrides Islands.

Cairngorm. Black or smoky yellow quartz, changed by heating to dark brown or yellow. National stone of Scotland; also called Scottish topaz. Often nearly opaque.

Carbuncle. A garnet cut *en cabochon;* that is, flat on the bottom, rounded above, without facets. In ancient times any red stone was called a carbuncle, and a mythical "carbuncle" was said to give out light in darkness.

SYNTHETIC RUBY IN THE MAKING



This is a boule for a synthetic gem, as described in the text. Until World War II, the United States was almost entirely dependent on Europe for synthetic gems needed in industry.

Carnelian, or Sard. Name given to brown and red chalcedony. It was much used for engraved seals in ancient times.

Cat's-Eye. The cheaper cat's-eye is of quartz, the more highly valued is of chrysoberyl. Colors range from apple green to olive, from yellow to brown, but each color has a streak or line through the middle of varying brilliance, like a cat's eye. Hindus value the stone second only to the diamond.

Chalcedony. A cryptocrystalline quartz, used by gem engravers since ancient times. Bible has many references to it. Color usually white, pale blue, or gray. Varieties include carnelian (or sard), chrysoprase, prase, plasma, bloodstone (or heliotrope), agate, onyx, sardonyx, jasper. Cheaper types are used for such articles as tabletops and vases. Found widely. Excellent stones from Brazil, Uruguay, Lake Superior region.

Chrysoberyl. A rare, unusually hard stone. One variety, the alexandrite, green by day and red by lamplight, had a great vogue among aristocrats of czarist Russia. Other varieties include chrysolite and cat's-eye.

Chrysolite. An olive-green vitreous magnesium iron silicate, also called olivine and peridot. It is crystalline and when transparent, used as gem.

Chrysoprase. An apple-green type of chalcedony.

Citrine. A yellow quartz resembling topaz. Much of it is produced by heat-treating other varieties.

Coral. Precious coral is red and branching, found in the Mediterranean. Black coral has been found in the Persian Gulf and on the Great Barrier Reef off Australia (*see* Coral).

Diamond. Pure crystallized carbon, the most highly esteemed of all gem stones (*see* Diamond).

Emerald. When large, brilliant, and flawless, the emerald is the costliest of gems. It is a variety of beryl. Chief source of deep green emeralds is Colombia. Lighter colored varieties are found in Brazil and occasionally in North Carolina.

Feldspar. Silicate feldspar produces several gem stones: amazonite, a bright green; moonstone, opalescent; sunstone, reddish; labradorite, gray with play of colors in blue and green and sometimes yellow, red, or gray. Found chiefly in Labrador.

Garnet. A deep red stone of several varieties, including almandite and pyrope, or Bohemian garnet. When cut *en cabochon,* both are called carbuncles. Garnet is found in nearly all colors but blue. The somewhat rare uvarovite is emerald green.

Girasol. A variety of opal. Iridescent in color.

Heliotrope. Same as bloodstone.

Hematite. Black crystalline iron; when finely divided, streaked with red. Popular for costume jewelry. Found in England, Norway, Sweden, Isle of Elba, Lake Superior region.

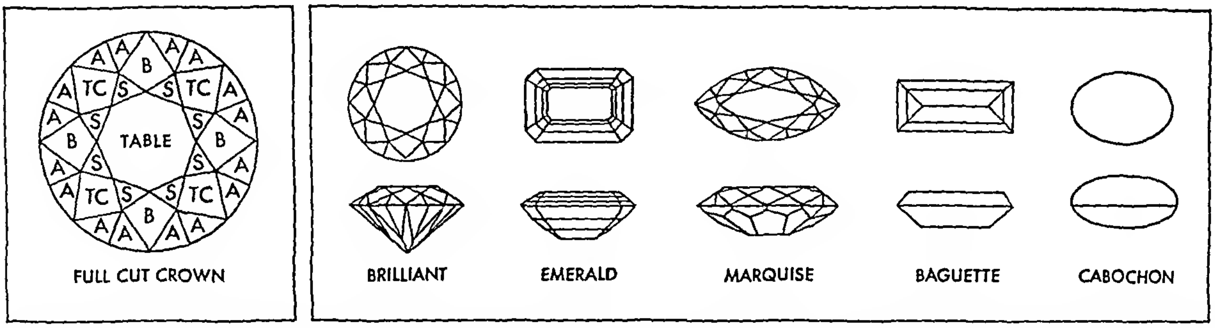
Hyacinth, or Jacinth. Variety of zircon.

Jade. A name applied to jadeite and nephrite. The color is usually green but sometimes a whitish cast appears. The stone takes a high polish. Jewelry, cups, and bells are made of it, and poems of Chinese emperors have been carved in priceless jade bowls. In China jade is considered the most precious gem stone.

Jasper. An opaque ornamental chalcedony, in red, yellow, brown, green, or gray-blue, used for vases, tables, mantels, and pillars. Jasper is often striped. Swiss or German lapis is jasper artificially colored.

Jet. A hard, black lignite (variety of coal). Takes high polish. Popular for ornaments and costume jewelry. Many jet articles manufactured in Yorkshire, England,

TYPICAL GEM CUTS FOR MODERN JEWELRY



At the left is the crown of a diamond in full-cut brilliant. The crown has 33 facets—1 table facet; 8 star facets (S); 4 bezel facets (B); 4 top corner facets (TC); 16 top half facets (A). The pavilion, or base, of the diamond has 25 facets. For large stones the brilliant cut is increased, by groups of 8 facets, up to 82 total facets. The emerald cut has a large, rectangular table; the marquise is a pointed oval; the baguette, a narrow rectangle; the cabochon, round or oval.

from local lignite and imports from Spain. Pennsylvania anthracite and Scottish cannel coal are often used in place of jet.

Labradorite. A pearl-gray or brown feldspar, showing many colors in light. Takes high polish.

Lapis Lazuli. The blue mineral lazurite. Mines in Afghanistan, worked for 6,000 years, probably world's oldest mines. Called "sapphire" by ancient world. Also found in Chile, Siberia, and southern California. Used for jewelry, mosaics, inlaid work, vases. Best varieties are gold flecked with iron pyrites.

Malachite. Bright-green ornamental mineral.

Marcasite. Differs from pyrite only in crystal structure; often set as brilliants in costume jewelry.

Moonstone. A milky translucent feldspar.

Morganite. A rose-colored variety of beryl. Named for J. Pierpont Morgan, American financier and collector of gems and art works.

Obsidian. A smoky natural glass of volcanic formation, abundant in Yellowstone National Park. Used by early Mexicans and North American Indians to make mirrors, arrowheads, and knives.

Olivine. A silicate of iron and magnesium. Bottle-green variety, best; others are peridot and chrysolite.

Onyx. The cameo carver's favorite material, chalcedony, with horizontal stripes of black and white. Also used for table tops, lamps, and decorations.

Opal. Noncrystalline silica, often combining several colors and frequently opalescent (milky and iridescent). Harlequin opals have flashes of color throughout; fire opals are yellow or red with a shifting glow; black opals are dark with colored lights; girasols have a bluish sheen. Gem opals are found in Australia, Honduras, Mexico, Nevada, and Idaho. The opal formerly had a reputation for bringing bad luck to the wearer.

Pearl. Not truly a gem stone but the product of pearl oysters. (*See* Pearls.)

Peridot. Dull-green olivine.

Plasma. A variety of green chalcedony.

Prase. A dull-green chalcedony.

Precious Serpentine. Translucent and rich green.

Pyrite. A pale yellow opaque iron disulfide.

Pyrope. A variety of garnet, often deep red.

Quartz. Crystalline silica, the commonest of all minerals. Gem varieties include rock crystal, amethyst, citrine, siderite, aventurine, chalcedony, cat's-eye, and rose, smoky, milky, and rutilated quartz.

Rhinestone, or Brilliant. Imitation gem made from special kinds of glass called *paste*, or *strass*. Colorless, sparkling, in imitation of diamonds. Rhinestone glass made from heating mixture of quartz, red lead, potassium carbonate, borax, white arsenic.

Rhodolite. A pink or purple variety of pyrope.

Rock Crystal. A clear quartz much used for beads, vases, goblets, and crystal balls.

Ruby. A transparent red corundum valued according to shade of color. The best grade is found in Burma, others in Siam, North Carolina, Montana. The most valuable shade is the purplish-red called *pigeon's blood*. Fine rubies of four or more carats are worth from two to five times as much as diamonds of the same size. Rubies seldom weigh more than eight or ten carats.

Sapphire. A transparent corundum, or aluminum oxide, found mainly in Kashmir, Ceylon, India, and China; poorer qualities in Australia and Montana. Best shade is *Kashmir blue*, a pure cornflower blue. Largest known weighs 916 carats.

Sardonyx. A variety of chalcedony with brown and white stripes or layers of carnelian and chalcedony.

Siderite. A rare, blue quartz.

Spinel. A red crystalline magnesium and aluminum oxide employed as a gem. The "Black Prince's ruby" in the imperial state crown of England is a spinel.

Sunstone. A reddish feldspar with fiery reflections.

Tigereye. Like cat's-eye, a chatoyant stone; that is, when polished, the interior shows an undulating light.

Topaz. An aluminum silicate occurring in various shades, such as yellow, brown, pale blue, green, or red, as well as colorless. The yellow *precious topaz* is mined in Brazil.

Tourmaline. A silicate, ranging from colorless to dark hue. Found in Ceylon, Madagascar, South West Africa, Siberia, Isle of Elba, Brazil, Maine, southern California. Names according to color: achroite, colorless; rubelite, rose red; Brazilian emerald, green; Brazilian sapphire, blue; Brazilian peridot, yellowish green; peridot of Ceylon, honey yellow; siberite, violet; indicolite, dark blue.

Turquoise. An aluminum and copper phosphate, from sky blue to apple green. Best grade from Iran, where it has been mined for 800 years. Also found in California, New Mexico, and Nevada. Heat and sunlight fade turquoise or turn it green.

Zircon. A silicate occurring in brownish, gray, yellow, green, blue, and colorless varieties. The last two are most popular as gems. Clear yellow, orange, red, and brown varieties are also known as *hyacinth*, or *jacinth*, and the term *jargon* is given to other colors. The most important deposits of gem zircons are found in Indo-China and Ceylon.

The Family Seder Highlights the Pesach (Passover) Holiday

The JEWS—*An* "ETERNAL PEOPLE"

JEWS. In the United States one of the great religions is Judaism, the religious beliefs and practices of the Jews. American Jews are thus citizens of the United States who follow the religious precepts of Judaism. In Israel Judaism is both a nationality and a religion. Israeli Jews are citizens of Israel, where religious and national life are intertwined. Elsewhere in the world, especially in western Europe, Jews are citizens of the lands in which they live, keeping their faith in God and their faith in nation separate as they do in the United States.

The Jews have a very long and continuous cultural and religious history. Broken into small groups, exiled to unfriendly lands, and subjected to many misfortunes, they have nevertheless continued to grow and contribute much to the world. They number less than one per cent of the world's population, but they have given world leaders in every field of human activity. With good reason they have been called an "eternal people."

Modern Judaism

Modern religious Jews, wherever they live, adhere to one of these Jewish movements: Orthodox, Conservative, or Reform. They differ in certain practices; their fundamental beliefs are the same.

Jews have no priests in the accepted sense. The rabbi is a teacher with no ecclesiastical authority. Without him the synagogue service can be maintained as long as there are at least ten men gathered to form a *minyan*. Any Jew with a knowledge of the prayers and laws can conduct religious services, perform marriages, and bury the dead. However, virtually all congregations have rabbis. They also have cantors who sing or chant much of the Sabbath and holiday services.

The modern American synagogue also conducts Hebrew language and religious (usually Sunday) schools. Here boys are prepared for the Bar Mitzvah service, and in Reform congregations, girls for the Bas Mitzvah service. In this ceremony the 13-year-old youth takes his or her place as a full-fledged member of the synagogue and of the Jewish community. Some congregations also have confirmation services for young people of high-school age. Regular parochial schools are maintained by some congregations.

The most important single Jewish prayer is the *Shemah*: "Hear, O Israel, the Lord our God the Lord is One." It proclaims the strict monotheistic beliefs of the Jews and the oneness of everything in the universe, from atoms through man to the stars. Jews have no lesser divinities or saints. They believe that God is the father of all mankind and that all men are brothers, equal in the sight of God. Rather than in a Messiah, they believe in the coming of a messianic era in which peace and earthly perfection will prevail.

LIGHTING THE SABBATH CANDLES

Here a mother lights candles to usher in the Sabbath on Friday evening. For 24 hours the holy day of rest and prayer is observed.

Jews have no special belief in an individual afterlife. They do not believe in any original or fundamental sin and hence do not look forward to salvation in the hereafter. They believe in living the good life in this world and achieving such immortality as they can through their descendants. Their word for "charity" actually means "righteousness"; and acts of charity are religious obligations that contribute to the good life. A good Jew is one who performs the prescribed rituals with a full heart; he also carries the ethics and morality of Judaism into his daily life.

American associations of synagogues and rabbis are voluntary, and the decisions they pass down are not binding unless voluntarily accepted. In Great Britain the Board of Deputies of British Jews has a semilegal status. It can, for example, designate which synagogues can perform legal marriages. In France the Consistoire Central is the central authority in the administration of synagogues and theological seminaries, placement of rabbis, and similar matters. In Italy the government imposes a special tax on Jews for the benefit of the Union of Jewish Communities.

Beginnings in Ancient Times

The history of the Jews begins when this people was a wandering Semitic tribe of the Arabian Desert. According to the Old Testament account, the great forefather of the Jews was Abraham (*see* Abraham). About 2000 B.C. he led his people out of Ur of the Chaldees into Palestine, or Canaan, as it was then called, to found a nation dedicated to the service of the one God. Because they came from beyond the Euphrates River, Abraham's tribe was called Hebrew, from a word meaning "the other side."

Isaac, who succeeded Abraham as patriarch of the tribe, had twin sons, Esau and Jacob. Jacob, also called Israel, gained the leadership. He was followed by his 12 sons, who became heads of the 12 tribes known as the Israelites. Jacob's son Joseph was sold as a slave by his jealous brothers, but his wisdom won him the post of prime minister of Egypt (*see* Joseph). In later years the Egyptians enslaved the Hebrews for work on supply depots and fortifications.

At this time Moses appeared to lead the Hebrews out of Egypt (*see* Moses). After 40 years of wandering in the desert, they were led to the Jordan River, where Joshua brought them into Canaan. During their desert years the Hebrews developed their religion from a worship of a tribal god to the recognition of a single universal God of all mankind.

In the Land of Canaan

In Canaan, or Palestine, the Jews turned from a wandering nomadic people into a strong settled nation. Canaan was divided up among the tribes; the priestly tribe of Levites dwelt among the others as religious leaders. Joshua won many victories over the Canaanites, but the Hebrews were still harassed by them and by other warlike tribes, especially the Moabites, the Ammonites, and the Philistines (*see* Philistines).

To lead the people during these troubled times, officers known as judges were appointed. Among the most famous were the warrior Gideon, the woman judge Deborah, and Samson, who performed great feats of strength. Later, in the time of the prophet Samuel, the people needed a strong central government ruled by a king. Saul was chosen for this office. He united the tribes of Israel into a powerful kingdom and won many notable victories, but both he and his son Jonathan fell in battle against the Philistines.

David was then proclaimed king, and peace was finally established (*see* David). Under his son Solomon the kingdom achieved its greatest prosperity and glory (*see* Solomon). When Solomon's son Rehoboam ascended the throne the ten northern tribes revolted and made Jeroboam king. Only Rehoboam's own tribe of Judah and the little tribe of Benjamin remained loyal to the house of David. In 930 B.C. the land of the Hebrews was divided into the northern kingdom of Israel and the southern kingdom of Judah, or Judea. The only bond between them was faith in the one God.

Feeling was bitter between the two kingdoms. Israel was rich; its land was fertile; its people lived in towns. Judea was stony and sterile; Jerusalem was its only large town; and most of the people clung to their old shepherd way of life. The prophets Amos, Hosea, and Isaiah warned Israel of the vast gulf between rich and poor and of the idolatrous practices the people were slipping into.

The Assyrian Conquest and After

Finally in 722 B.C. the Assyrians captured Samaria, the capital of Israel, carried most of the people into

slavery, and put an end to the kingdom of Israel. The little kingdom of Judea endured for a little more than a hundred years, remaining faithful to the ancient religion. Finally in 597 B.C. Nebuchadnezzar's Babylonian army stormed Jerusalem. They ransacked the city and took many prisoners. In 586 they returned and destroyed the city, including the temple and the king's palace. The history of the Jews seemed to be at an end.

However, the exiles to Babylonia, sparked by the teachings of the prophets, kept the faith alive (*see* Prophets). They developed the revered Torah from the first five books, or Pentateuch, of the Old Testament. The Torah gave the exiles a feeling of national unity away from their lost homeland.

A half century later the Babylonians were conquered by the Persian king Cyrus. He permitted the Jews who so desired to return to Jerusalem and rebuild the temple. Later the prophet Ezra led another group back to Jerusalem and brought about a great religious reawakening. Nehemiah, a Persian Jew, was appointed governor of Judea and did much for his people. During this period the Old Testament was collected and arranged, and the religion of Judaism began to reach its present form.

For 200 years Judea was ruled by the Persians with justice and honesty. Then Judea became a province of the Greek-ruled Syrian empire. The Syrian king Antiochus Epiphanes angered the Jews by ordering the people to worship idols. The aged Jew Mattathias revolted, and under the leadership of his five sons, called the Maccabees, the Jews defeated the Syrian army and won their independence in 165 B.C.

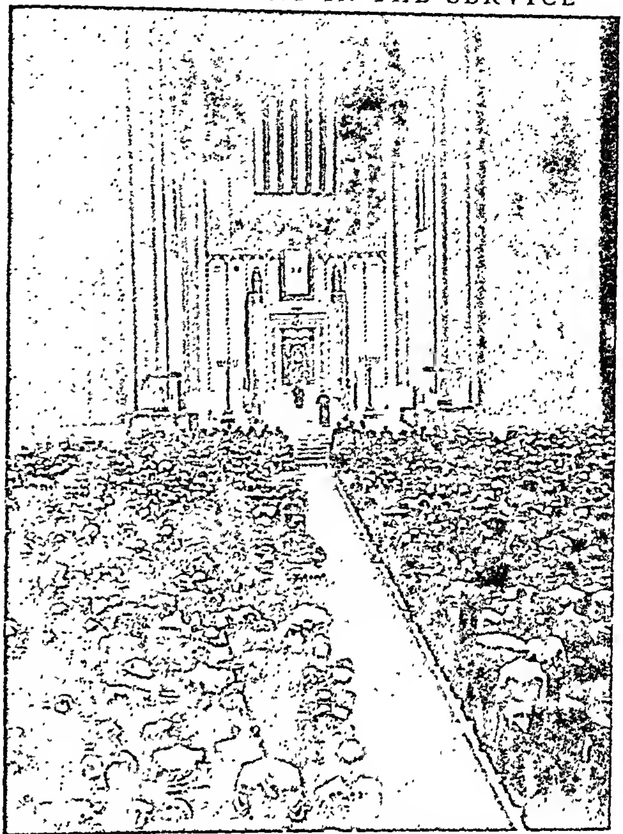
After some years the people became divided into sects, principally the Pharisees and the Sadducees. Rome, with whom an alliance had been formed, was called in to settle a dispute between the two rival sects for the throne. The Roman general Pompey took advantage of the situation to make himself master of Jerusalem. He appointed Antipater, a Jew from Edom, as governor of Judea. Antipater's son and grandson ruled from 40 B.C. to A.D. 39 (*see* Herod). Under the Roman governors who followed, there were many uprisings, ending in the great Jewish war of A.D. 66. After a long siege the Roman general Titus, afterward emperor, took Jerusalem in A.D. 70, burned the temple, massacred thousands of Jews, and took more thousands to be sold as slaves.

World-Wide Migration

During the period of Roman domination the Jews left Palestine for such widely scattered places as Rome and Alexandria. After the destruction of Jerusalem, many others settled in North Africa and in the Mediterranean cities. Later they spread into central and western Europe, expecially Spain. They did not reach England until after the Norman Conquest. Still other Jews traveled eastward into Asia.

In the Middle Ages the scattered communities of Jews opened channels of trade and communication between isolated countries. Feudal lords welcomed them for their knowledge of trade and science. As bankers, physicians, and merchants they received special consideration, especially at the court of Charlemagne and among the Moors in Spain.

A HIGH MOMENT IN THE SERVICE



At Temple Emmanu-el, in New York City the congregation rises as the Ark of the Convenant, containing the Torah, is opened.

However, with the increase of religious intolerance during the Crusades, the Jews were expelled from England in 1290, from France in 1306, and from Spain in 1492. They were not permitted to return for many centuries. In other European countries they were forced to live in crowded *ghettos* and wear special clothing or badges. They were forbidden to own land or to join the guilds. Only moneylending and trading in secondhand goods remained open to them. Deprived of civil rights and protection, they lived in constant fear of *pogroms*, mob violence and massacre.

In times of privilege and terror alike, the Jews clung to their religious and communal unity. Their rabbis (spiritual leaders) led in the building of synagogues (houses of worship) and in establishing schools in which Hebrew was taught (*see* Hebrew Language and Literature). The old dietary laws of Moses were kept. No pork was eaten and meat and dairy products were not eaten at the same meal. Approved foods were called *kosher* (ritually clean). Rosh Hashana (New Year's Day), Yom Kippur (Day of Atonement), Pesach (Passover), and other old holidays were still celebrated.

Jewish Emancipation in Modern Times

The social reforms which accompanied the rise of democratization in the 18th century included Jewish emancipation. By 1870 all western and central Eu-

rope had granted the Jews equal rights with other citizens. However, in Russia, Poland, and Rumania the Jews continued to exist under semimedieval conditions until the 1900's.

In Germany the new Reform movement was born in the 1800's. This was a departure from the older Orthodox and the more recent Conservative methods of worship. Prayers and sermons were offered in the local languages rather than in Hebrew, and organs and mixed choirs were introduced. Men and women sat together, and no hats were worn at services. These were all minor variations; the main themes of monotheism, virtuous living, tolerance, and peace were still stressed in all forms of worship.

Growth of Modern Anti-Semitism

In Europe a minority among the gentiles refused to accept Jews as equals. Their prejudice was based partly on assumed racial differences between "Aryans" and "Semites." Anti-Semitism began in Germany about 1875 and spread to Austria and Hungary. In 1881 it touched off a widespread pogrom in Russia. The next year the Russian government passed the notorious "May laws," which drove the Jews off their farms and herded them into town ghettos. In France anti-Semitism flared up when a Jewish army captain, Alfred Dreyfus, was charged with treason in 1894. The case against him was later proved to have been based on forged documents.

When Hitler came to power in Germany in 1933 he launched his anti-Jewish program at once (*see* Hitler). In 1938 he ordered a mass arrest of all Jews in Germany. Some Jews emigrated; others were driven to suicide. Thousands were imprisoned in concentration camps. After 1939 German conquests brought millions of Jews under Nazi domination. Jews were rounded up and sent to eastern Europe where they were executed wholesale in the gas chambers of the extermination camps. When Germany was finally defeated, it was estimated that 6 million Jews had been killed in the mass slaughter.

The New State of Israel

Through the centuries many Jews, particularly in eastern Europe, believed that the only way to solve their problems was to establish a Jewish nation in Palestine. In 1897 Theodor Herzl, a Viennese journalist, called the first international Zionist congress at Basel, Switzerland. This congress established the Zionist Organization dedicated to the creation of a Jewish state in Palestine.

In 1917 Great Britain lent support to the project. At the close of World War I Palestine passed to Britain as a mandate, and the Zionists' dream seemed about to be realized. However, the surrounding countries were hostile, and Arab resentment broke out in violence. Events dragged until after World War II. Finally the British withdrew from Palestine in May 1948, and the Jews proclaimed the state of Israel (*see* Israel).

The Zionist Organization of America raised huge sums to promote the new state. After World War II, the first of the new waves of immigrants to arrive

NEW YEAR'S DAY CEREMONY

On Rosh Hashana (New Year's Day) the ram's horn, or *shofar*, is blown to hail the new year. Blowing the shofar is an honor.

were the "D. P.'s" (displaced persons) from western Europe. Then came a flood of immigrants from the Communist countries of eastern Europe and finally people from North Africa and the Middle East. Despite aid from United States citizens, the new country faced serious problems of survival.

The Jews in America

The first Jewish community in America was established in New Amsterdam (New York City) in 1654 by refugees from Brazil. They followed the Sephardic rites of the Jews in Spain. By the time of the American Revolution there were about 2,000 Jews in the total population of 3 million Americans. From 1830 to 1870 German Jews came to the United States in great numbers. Until 1924 they were followed by Jews from eastern Europe, who adhered to the Ashkenazic rites.

From the first, American Jews were almost completely free of the anti-Semitic blight that ravaged Jews in other lands. They were free to become true Americans, distinguished from their fellow citizens only by their religion and by their voluntary attachment to Jewish culture. A few former American Jews have become citizens of Israel. The remainder—an overwhelming majority—have given freely of time and money to aid the new state, but have chosen to remain Americans in every sense of the word. They have a single national loyalty to the United States and a single, separate religious loyalty to Judaism.

Books about the Jews

Ausubel, Nathan. Pictorial History of the Jewish People (Crown, 1953).

Bernstein, P. S. What the Jews Believe (Farrar, Straus, 1950).

Cohen, Abraham. Everyman's Talmud (Dutton, 1949).

Goldin, H. E. Treasury of Jewish Holidays (Twayne, 1952).

Grayzel, Solomon. History of the Jews (Jewish Pub., 1947).

Kertzer, M. N. What Is a Jew? (World, 1953).

Kobler, Franz, ed. Treasury of Jewish Letters, 2 v. (Farrar, Straus, 1953).

Steinberg, Milton. Basic Judaism (Harcourt, 1947).

Taylor, Sydney. All-of-a-Kind Family (Wilcox & Follett, 1951).

Williams, A. N. Holy City (Little, 1954).

The Glorious, Tragic STORY *of the* MAID *of* FRANCE

JOAN OF ARC, SAINT (1412–1431). One of the most romantic stories in European war history is that of Joan of Arc, a girl who saved France from English domination. Although only 17 years old, Joan inspired a French army to break the English siege of the French city of Orléans and to win other important victories. She is known as the "Maid of Orléans," and as the "Maid of France."

Joan of Arc (the French form is *Jeanne d'Arc*) was born in the tiny village of Domrémy, in the valley of the Meuse, on Jan. 6, 1412. She was the daughter of a wealthy peasant farmer. From her pious mother she learned the arts of spinning, sewing, and cooking and to love and serve God. With her brothers and sisters she herded cattle and sheep and cut ripe grain in her father's fields. Busy as these tasks kept her, there was still time for singing and dancing, for playing games with other children, and for gathering flowers for the church altars. There was seldom a day that she did not kneel in prayer in the cool, lofty gloom of the church.

France of Her Day

For almost a hundred years France and much of Europe had been fighting in what has become known as the Hundred Years' War. The English occupied much of northern France and the Duke of Burgundy was their ally. The impoverished French King Charles VII had not yet been crowned and so was called the Dauphin. Reims, where the coronation ceremonies for French kings had been held for a thousand years, lay in enemy hands (*see* Reims). The valley of the Meuse, where Joan lived, was constantly overrun by armies and guerrilla bands. Domrémy's sympathies and loyalties lay with the uncrowned king.

Visions from Heaven

The pious girl was only 13 years old when she first saw a heavenly vision. Saint Michael, she later said, told her to be a good girl, to obey her mother, and to go to church often. For some time she told no one of the visions. When Saint Catherine and Saint Margaret commanded her to journey to the Dauphin so that she might inspire his armies to clear the way to Reims for the coronation, she told her parents and others. Her father, believing the visions only girlish imaginings, refused permission for the journey.

Joan's visions continued to command her. Her friends, who believed her truly inspired, secured boy's clothing and a horse for her. Several rode with Joan on the long trip to the Dauphin's court at Chinon. Perhaps as a test, the Dauphin made one of his courtiers pretend to be the king. Joan, however, went directly to the true king and greeted him.

The Dauphin and his councilors were not entirely convinced of her mission, however. Months of doubt and indecision followed while the Maid was questioned. Slowly an army was gathered.

Maid of Orléans

The Dauphin equipped her with armor, attendants, and horses. A special banner was made. One side bore a figure of God, seated on clouds and holding a glove, with kneeling angels at His side, and the words "Jesus Maria." The other side had a figure of the Virgin and a shield, with two angels supporting the arms of France. Joan carried this banner into battle.

The army at last moved toward Orléans. Joan was not its commander, but her presence inspired officers and men with confidence of victory. At Orléans Joan disapproved of the plans made for entering the besieged city. Her suggested plan was adopted and the entrance safely made. From the city she led a series of sallies that so harassed and discouraged the English that they withdrew. In one of the skirmishes Joan was wounded. On May 8, 1429, the victory was celebrated by the first festival of Orléans.

JOAN RECEIVES A HEAVENLY MESSAGE

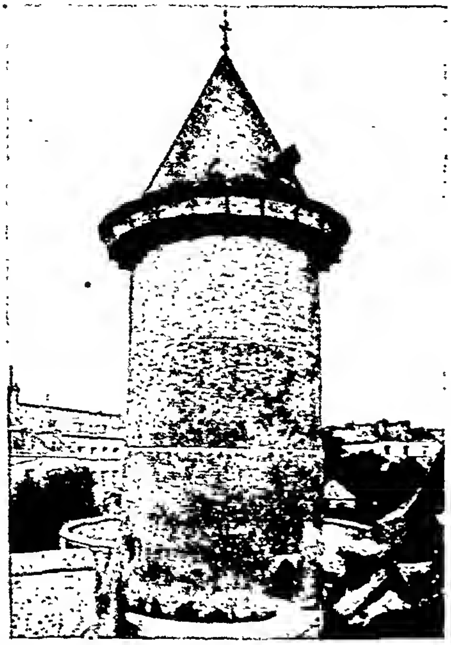
Joan of Arc saw many visions, the first when she was only 13 years old. The painter Eugene Thirion depicts Joan's awe as Saint Michael tells her she is commanded to inspire and lead the Dauphin's army to victory over the English.

Soon several other important points were taken by the army of the Maid. Her army entered Reims on July 14. Two days later the Dauphin was crowned king. The Maid with her banner stood at his side. (*See also* France; Hundred Years' War; Orléans.)

Royal Indecision and Capture of the Maid

It was decided to attack Paris, but the new monarch's hesitation and indecision prevented the Maid's soldiers from concerted attack. Nevertheless, Compiègne and other nearby towns were taken. A

JOAN'S PRISON TOWER



Joan of Arc was imprisoned in this tower in Rouen. The tower, all that remains of a great castle built in the 13th century, now contains relics of Joan.

French attack on a Paris salient was driven back and Joan was again wounded. Charles VII disbanded his army for the winter and retired southward. Through the cold months the Maid chafed at royal delay.

In the spring the Maid returned to Compiègne, now besieged by forces of the Duke of Burgundy. On May 23, 1430, Joan on a sortie into the Burgundian lines was separated from her soldiers and captured.

Trial and Execution

As a prisoner at Beaurevoir, she attempted to escape, but was injured in the leap from the donjon tower. Later she was sold to the English who vowed that she would be executed. They removed her to Rouen, near the mouth of the Seine, where she was held in chains.

Although the English wanted Joan's death, they desired her to be sentenced by an ecclesiastical court. The Burgundian-controlled University of Paris provided the charges of heresy and witchcraft; they also provided some of the members of the court. Other members came from areas under English occupation. Chief of the court was the Bishop of Beauvais.

The Maid was handed over to this bishop on Jan. 3, 1431. The sittings began on February 21 and continued intermittently for months. Joan's appeal to be sent before the pope for judgment was denied. On May 23 she was condemned to be burned unless she recanted. She had been held for many months in chains, threatened with torture, and harassed by thousands of questions. In spite of all this, she had maintained her shy innocence, often confounding her oppressors with simple, unaffected answers to tricky questions. Saint Catherine and Saint Margaret, she said, still counseled her.

Faced with death in the flames, she recanted, but many historians think she did not understand what was meant in the statement of recantation. As a result of her submission, her punishment was commuted from death to life imprisonment. This leniency enraged the English, and it was not long before the Maid was accused of relapsing from her submission. On May 30, 1431, then only 19 years old, she was turned over to civil authority and burned at the stake.

Charles VII had made no effort to save Joan. Some 25 years later he did aid her family to appeal the case to the pope, and in 1456 a papal court annulled the judgment of 1431. On May 16, 1920, Joan of Arc was canonized a saint by the Roman Catholic church. In the same year the Orléans' festival for the Maid became a French national holiday. Joan of Arc's heroic deeds and her infamous trial and execution have inspired many writers and artists.

JOB. A sublime treatment of man's integrity under great suffering is given in the Old Testament Book of Job. The hero of this dramatic poem is a wealthy chieftain of the land of Uz, somewhere to the southeast of Palestine. Job is noted as a God-fearing and upright man. To test his righteousness, God permits Satan to afflict him with terrible misfortunes—the loss of his children and property and an attack of a loathsome form of leprosy.

When Job cries out in anguish, friends come to tell him that God afflicts him because he has been sinful. Job, secure in the knowledge of his own righteousness, refuses to believe this, and he cries out to God for the real explanation. Although attacked by pain and discouragement, Job has not lost faith. "I know that my Redeemer liveth," he says, and God, speaking out of a whirlwind, answers him. Job bows in submission when he realizes that the great mysteries are beyond man's understanding.

Scholars believe the Book of Job to have been written between 300 and 400 years before Christ. It is among the latest of the Old Testament books. Modern readers turn to it for its magnificent literary quality as well as for its moving spiritual message. Job, as a real person, may not have existed but the story may have its foundation in fact. The Book of Job has inspired such poetic masterpieces as Shakespeare's 'Hamlet' and Goethe's 'Faust'. These also attempt to explain man's spiritual doubts and turmoil.

JOFFRE (*zhô'fr'*), **JOSEPH JACQUES CÉSAIRE** (1852–1931). Because Marshal Joffre halted the German invasion of 1914 on the Marne River he has been called the "victor of the Marne." He was born Jan. 4, 1852, in the extreme southern part of France. His father made wine casks. The boy was so little interested in this work that his father declared, "If Joseph amounts

In 1914 Joffre turned the Germans back.

to anything it will be at his books." So the future marshal of France was sent to prepare for a military career at the École Polytechnique in Paris.

Before he had completed the course, Joffre was called to arms in the Franco-Prussian War of 1870–71. He saw the victorious Germans march into Paris. In the next 40 years he prepared himself and France for the next Prussian blow. He spent some of those years in the French colonies in Africa and Asia, and he superintended the building of many important defenses. In 1914 at the outbreak of the first World War he was the French chief of staff. He was made supreme commander of the French forces on the Western front; he held this post for two years.

Before the powerful German thrust, Joffre retreated from Belgium into France. Many Frenchmen feared that the German boast to "take Christmas dinner in Paris" would be realized. Joffre, however, was choosing his own time and his own ground for battle. On Sept. 6, 1914, after five weeks of retreating, he gave the command for attack. The result was the victory of the Marne. All France acclaimed "Papa," an affectionate nickname given him by his troops, as the savior of his country.

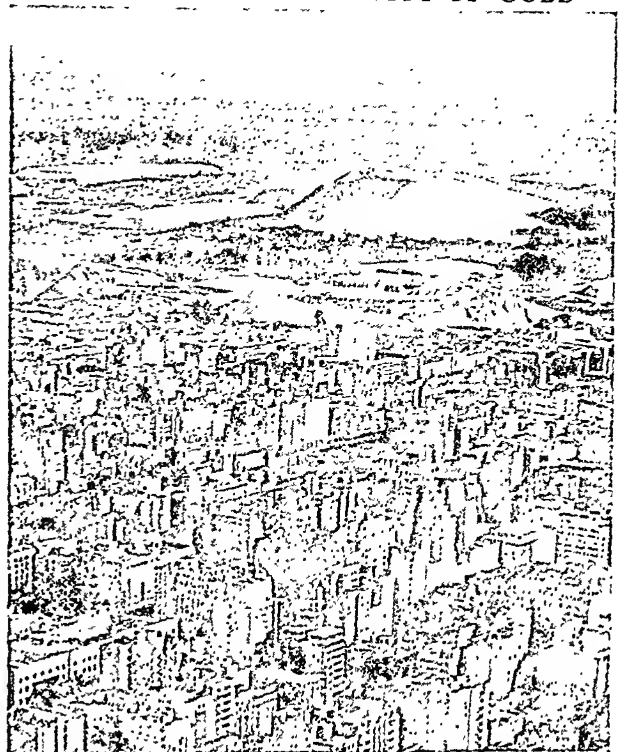
His country rewarded him by making him marshal of France and decorating him with the grand cross of the Legion of Honor. Joffre's removal from supreme command came in December 1916, following reverses at Verdun. Afterward he served on the French High Commission as technical adviser. In 1917, as a member of this commission, he visited the United States. He died in Paris Jan. 3, 1931.

JOHANNESBURG (*jō-hăn'ĭs-bûrg*), UNION OF SOUTH AFRICA. Although it was not established until 1886, Johannesburg is the largest city in the Union of South Africa. It is called the "city of gold" because gold was discovered on the site in 1885. The gold-bearing reef, the Witwatersrand (ridge of white waters), popularly called the Rand, extends to unprobed depths over an area more than 50 miles long. Mine shafts and tunnels penetrate deeply, some reaching under the city itself. When dynamite is exploded in these tunnels the city quivers as though shaken by a slight earthquake.

Johannesburg, more than a mile above sea level, lies on rolling *veld* (prairie) in the southern part of the Transvaal province. It is a center for international air travel and for rail lines that lead to all points of the Union and into the Rhodesias. The city's latitude and elevation provide a mild climate. When settled, the site had only a few scrub trees, but now trees and gardens flourish under care.

Tall buildings, some more than 20 stories high, overlook the narrow downtown streets. Streets are more spacious in other parts of the city. To the north lie gardened suburbs. To the south are the districts where the poorer Europeans live. The Negro "locations," areas to which Negro living quarters are restricted, also lie south of the city. (South African whites use the term "natives" when speaking of Negroes. European-descended whites are termed

JOHANNESBURG—THE "CITY OF GOLD"



Johannesburg, South Africa's largest city, is the world's greatest gold-mining center. In the background lie piles of wastes; these remain after gold has been extracted from the ore.

"Europeans.") Most buildings in these areas are huts made of dried mud, packing cases, and flattened tin cans. Here meals are cooked over fires lighted in the somewhat smelly streets.

The University of Witwatersrand was founded in Johannesburg in 1922; it has a student body of about 5,000. The Johannesburg Technical College is also here. The Institute of Medical Research is the largest such institute in Africa. Negro art is shown in the Africana Museum; the Municipal Art Gallery exhibits other art work. The Zoological Gardens and the Observatory are points of interest.

When gold was discovered on the site in 1885, it held only a few shanties. The townsite laid out in 1886 was named for Johannes Rissik, the surveyor general of the Transvaal. Johannesburg grew quickly. In 1896, when the Transvaal (which was then independent) permitted it a municipal government, it had about 102,000 people, half of whom were Europeans. Johannesburg was a center of the Boer-English differences that brought about the Boer War, and during much of the war it was occupied by the English. (*See also* Boer War; South Africa, Union of; Transvaal.) Population (1951 census, preliminary), 880,014; about half the people are Negroes.

JOHN, KING OF ENGLAND (1167–1216). Vicious, shameless, ungrateful, King John holds the title of the worst king that ever ruled England. Yet the very excesses of his reign provoked such violent reaction that his subjects revolted and forced him to put his seal on Magna Carta, the document that became the bulwark of English liberty.

John was nicknamed "Lackland" because, unlike his elder brothers, his father, King Henry II, at first gave him no possessions on the Continent; but later he was endowed with castles, lands, and revenues on both sides of the channel. John showed his characteristic ingratitude by joining his brother Richard the Lion-Hearted in conspiring against their father, and it was the discovery of this treason that brought the old king to his grave. When Richard became king he confirmed John in his possessions and added others; but John again conspired during Richard's absence on the Third Crusade.

The Barons Choose John as King

On Richard's death in 1199 the barons chose John to be king, despite the claim of his nephew Arthur, the son of another brother, Geoffrey, who had died some time before. Two French provinces took up arms in young Arthur's support, but he himself fell into the king's hands and died soon after, undoubtedly murdered by John's command. In the war which followed, on other grounds, with the king of France, John lost all his French possessions except Aquitaine.

Then came a quarrel with Pope Innocent III over the nomination of Stephen Langton as Archbishop of Canterbury. John resisted the pope's choice, and in the struggle he was excommunicated and the nation was put under an interdict; that is, all religious services were forbidden except baptism and extreme unction. John's resistance was broken at last by the pope's threat to depose him and by the growing disaffection of his subjects. He not only received Langton as archbishop, but he abjectly agreed to hold England as a fief from the pope and to pay a yearly tribute. While John was absent on the Continent, seeking to regain his forfeited fief of Normandy, the barons of England united to resist the tyrant's rule. They mustered a powerful force and with the encouragement of Archbishop Langton marched against the king demanding a charter of liberties. Deserted by all but a handful of mercenary followers, John wrathfully recognized his powerlessness, met the barons at Runnymede on June 15, 1215, and put the royal seal upon the Great Charter (*see* Magna Carta).

But John had no intention of abiding by his grant and sought the pope's aid to free him from his oath to support the Charter. He raised an army and harried with fire and sword the estates of the barons, who in despair offered the crown to Louis, the son of a French king. Louis landed with a great army, and received the submission of a large part of England. In the midst of the war, while the issue was still doubtful, John died of a fever—caused, it is said, by eating too heartily of green peaches and new cider—leaving to his nine-year-old son, Henry III, the task of restoring the distracted kingdom.

The STORMY CAREER *of* ANDREW JOHNSON

The Tailor's Apprentice who Became President—How, in the Bitter Politics of a Border State, He Fought to Keep the Union from Breaking and Later Fought with Congress as to the Best Policy in Putting It Together Again

JOHNSON, ANDREW (1808–1875). "The only way to fight error is to strike it a direct blow," Johnson once said. "Hit it between the eyes and drop it to its knees. If it trembling rise again, strike it and continue to strike, till it shall rise no more."

And on another occasion he said: "When I die, I desire no better winding sheet than the Stars and Stripes, and no softer pillow than the Constitution of my country."

These sentences express the emotions which dominated the entire life of Andrew Johnson, who was once the most bitterly hated man who ever sat in the presidential chair, but who is now coming to be recognized as one of the great figures of his times.

Johnson was born in Raleigh, N. C. His father died when the boy was four years old, and at the age of ten Andrew was apprenticed to a tailor so that he might learn to make his own living. He had never gone to school a day, but while working as an apprentice he determined to learn to read. A gentleman frequently visited the tailoring shop where he worked and read to the employees speeches of British statesmen. Young Johnson was so interested in these that the man gave him the book, and with the aid of his fellow-workers he learned to read the speeches for himself. After he was married and had started in business for himself at Greeneville, Tenn., his wife taught him to write and to do simple problems in arithmetic.

At the age of 20, Johnson began his political career in the humble position of alderman of Greeneville. He was elected to the office as the workingmen's candidate, in opposition to the slaveholding aristocracy of the town. From this time on, until 1843, he served almost constantly as alderman, mayor, or member of the state legislature.

In Congress, where he served from 1843 to 1853, as in local offices, he still represented the interests of the common people. In 1845 he introduced the first "homestead bill," to give landless citizens farms from the public lands. The bill was defeated by the slaveholders of the South, because it would mean eventually more free states in the Union; but the issue was brought up again and again, until it was finally passed in 1862, after the secession of the slave states.

The aristocracy of the South not only opposed Johnson's homestead policy, but they also despised the man because he had worked with his hands. He is probably the only man in the South, before the Civil War, who having done manual labor for a

living still won the proud positions of state governor (1853–55) and United States senator (1855–62).

When secession came in 1860–61, Senator Johnson attracted the attention of the North by his arguments for the Union, and he was the only Southern senator who did not resign and go with his state. In the border states the feeling between the Unionists and Confederates was more bitter than anywhere else. Johnson's work for the Union in Tennessee, and his acceptance of the position of military governor in 1862, show his great physical courage, as well as his loyalty. He organized the part of the state which was under control of the Northern forces, and began the work of reconstruction, in which he was destined as president to play a prominent part. His experience, however, was entirely with local affairs and he had little acquaintance with people and problems on the national stage.


ANDREW JOHNSON

In recognition of his work for the Union, and to secure the votes of the war Democrats, to which party Johnson belonged, the Republicans in 1864 nominated him for vice-president on a Union ticket with Lincoln.

President at Lincoln's Death

When Johnson was called to the presidency by the assassination of Lincoln, in 1865, he was confronted by the most difficult situation a president ever had to face. The war was over, but its ravages were still to be repaired and the Union restored. The bitterness of the people of the North was increased by the death of Lincoln, for which they held the South responsible; and a triumphant majority of both houses of Congress were demanding harsh measures against the defeated states.

JOHNSON'S ADMINISTRATION
(April 15, 1865–1869)

Amnesty Proclamation (1865).
13th Amendment ratified (1865).
Civil Rights Act passed over President's veto (1866).
Cable to Great Britain completed (1866).
Reconstruction bill passed over veto (1867).
Nebraska admitted (1867).
Tenure of Office bill passed over veto (1867).
Alaska purchased from Russia (1867).
French forced to quit Mexico (1867).
14th Amendment ratified (1868).
President acquitted on Impeachment trial (1868).
15th Amendment ratified (1869).

It was a situation which would have taxed the great powers of Lincoln, and it exceeded those of the former vice-president. With all his ability and honesty, Johnson had never made good the defects of his early training. He was tactless, lacking in good taste, boastful, given to abusive speech, and fond of quarreling; while the leaders of Congress were men with whom Lincoln would have been forced to differ.

At first many leaders of Congress thought "the accession of Johnson to the presidency would prove a godsend to the country." They felt that Lincoln would have been too merciful to the South, and that as Johnson had always been bitter toward the "rebels," the country would be safer in his hands. Senator Wade, of Ohio, said to him: "We have faith in *you*. By the gods, there will be no trouble now in running the government."

During his first weeks in office Johnson seemed to justify their faith. He loudly proclaimed that "treason must be made odious, and traitors must be punished and impoverished." But suddenly he changed his attitude and adopted the merciful policy of Lincoln, with infinitely less chance of success.

Before Congress met in December he had recognized state governments in all of the seceding states which had not been reconstructed under Lincoln. Congress refused to admit members from these states, and proceeded to ignore Johnson's acts and to lay down a far more severe policy for the treatment of the South. The remainder of Johnson's administration was the bitterest fight ever waged between a president and his congress. Johnson was a firm states' rights Democrat. Hence he vetoed a bill that would have increased the powers of the Freedmen's Bureau, which had been established as a guardian of emancipated slaves. He also vetoed a Civil Rights bill which would have put all cases involving Negro rights under United States courts rather than state courts. Johnson held that both these bills were unconstitutional and gave opportunity for dishonesty in administration. But Congress passed them over his veto, and then proposed the 14th amendment to the Constitution, the effect of which was to deprive the Southern states of their full share of representation in Congress unless they gave the Negroes the right to vote, and to exclude from office all who had taken part in the rebellion until they were pardoned by a two-thirds vote of each house.

Before the elections of 1866 the President appealed to the people to support his policies. He

made a tour through the country—known as his "swing around the circle"—during which he spoke bitterly of Congress; but he lost support, rather than gained it, by his personal abuse of his opponents.

In 1868 the quarrel between Johnson and the partisan leaders in Congress came to a head. Johnson sought to remove Edwin M. Stanton as his secretary of war to make room for General Grant. This was in violation of a Tenure of Office Act passed by Congress in 1867 to tie the President's hands. Stanton resented removal and the Senate upheld him. The high-handed majority in Congress then determined to impeach Johnson himself and remove him from the presidency. The grounds of the charges were admittedly political. The vote in the Senate, which acts as the court of trial in impeachment proceedings, stood 35 for removal and 19 against it. As 36 votes—two thirds of the members—were necessary for conviction, Johnson's impeachment was not upheld and he was permitted to serve out his term of office. (*See also* Impeachment.)

The Trouble over Mexico

The bitterness of the struggle over reconstruction and the disorders of the carpet-bag governments in the South blinded the people to an important development in international relations. During the Civil War the French emperor, Napoleon III, had placed Archduke Maximilian of Austria on the Mexican throne and kept him there by means of a French army. For a time the United States was too busy with its Civil War to do more than protest against this violation of the Monroe Doctrine; but in 1867 President Johnson forced the French to withdraw. Maximilian was then captured and shot to death by the Mexican patriots. (*See also* Mexico.)

Another international development was the purchase of Alaska in the same year—bought from Russia for $7,200,000 on the recommendation of Secretary of State Seward. Gold had not yet been discovered in that region, and most people looked upon Alaska as a cold, barren waste. They thought the purchase was a bad bargain and contemptuously referred to it as "Seward's folly." (*See also* Alaska.)

For a long time partisan feeling blinded people to the good points in Johnson's policy. Today most historians agree that much of the bitterness and most of the evils of the reconstruction period would have been averted if Congress had followed his leadership.

"No American has ever had a lonelier or more treacherous path to tread," says one of his recent biographers. A fighter to the end, he went back to his own state to seek vindication. His triumph came at last in 1875, when he was elected senator from Tennessee. He was the only ex-president who was ever elected to the Senate. Public feeling had changed, and congratulatory messages poured in from all parts of the country. His victory was too late. He died on July 31, 1875, a few months after his election.

JOHNSON, SAMUEL (1709–1784). The most famous man of letters in 18th-century England was Samuel Johnson. His fame rests not on his writings, which are seldom read today, but on his friend James Boswell's biography of him. Boswell's books are the main source of "Johnsoniana"; but later biographers have found much additional material on his life and literary career. More has been written about Johnson than about any other English author except Shakespeare.

Johnson was a fascinating, complex person. Tall, heavy, and clumsy, he had a scarred complexion and nearsighted eyes. He was slovenly in dress and at times extremely lazy. He would often be seen muttering and making faces. His temper was quick, and in at least a few arguments he knocked his opponent down with a blow from his fist.

However, Johnson's good qualities far outweighed the bad. He had great pride, and even in his poorest days he would accept no charity. He had realistic good sense and an abiding hatred of hypocrisy. He loved to eat, to drink quarts of tea, and, most of all, to talk. Johnson was the most brilliant conversationalist of his time. His store of knowledge was large and well organized. Despite some amusing prejudices, he was usually a good judge of men and books.

Through Johnson we meet such men as Sir Joshua Reynolds, noted portrait painter; David Garrick, the finest actor of his time; and Oliver Goldsmith, author of 'The Vicar of Wakefield'. Through Johnson we see 18th-century London at its worst and best. We see the drafty garrets where talented authors labored at hack work and the cheap taverns where they dined for a few pennies. We see the fine homes where Johnson—after he became famous—was a welcome guest, the theaters and coffeehouses, the pulsing activity of the world's largest city.

Johnson's Early Years

Johnson was born Sept. 18, 1709, in the village of Lichfield, England. In infancy he suffered scrofula, which left its effect on his face and eyesight. His father was a bookseller and the boy read widely in his father's books. Awkward and gangling, he did not join in their games, but he was popular with other boys because he helped them with their lessons.

After several years in Lichfield schools, Johnson was ready for college. His father, never very prosperous, was now in debt. However, some money was scraped together and the 19-year-old youth was able to attend Pembroke College, Oxford, for a year. His teachers liked him for his knowledge of Latin and Greek, and his fellow students for his ready wit.

Without money and with an appearance that at first repelled people, Johnson struggled for several years at a series of mean jobs. At 26 he married Mrs. Elizabeth Porter, a widow 20 years his senior. Despite the difference in their ages, the two remained devoted to each other until her death in 1752. They had no children. After his marriage Johnson started a school. It attracted only a few students and within a year it was closed. Johnson left his wife behind temporarily and with one of his students, young David Garrick, he went to London to find work.

His early days in London were extremely hard. He reported parliamentary speeches, taking care as he

JOHNSON AND BOSWELL STROLL AND TALK

Here, where Fleet Street meets the Strand in London, once stood Temple Bar, a gateway designed by Sir Christopher Wren. Along this rough street Samuel Johnson and James Boswell often walked leisurely. Johnson talked much and Boswell listened intently, occasionally asking the older man a question to renew Johnson's stream of brilliant observations on many subjects.

frankly said "that the Whig dogs should not have the best of it." He did translations for publishers, his knowledge of Latin and Greek serving him well. He made catalogs for booksellers. Hard as Johnson worked, he barely made a living for himself and his wife. Often he walked the streets at night for the want of money for a lodging. Even in those pinching times, he would put pennies into the hands of poor children sleeping in the streets. For all his brusqueness, he was always gentle of heart.

The Famous Johnson Dictionary

Gradually Johnson's reputation grew. He became well known to the publishers and booksellers of London. One of them, Robert Dodsley, suggested that an English dictionary would be well received by the public. Johnson had already dreamed of such a work, and when a combination of booksellers offered him about $7,800 for the undertaking he accepted. The amount seems large but the 'Dictionary' took almost eight years to complete, and Johnson had to pay his assistants out of his own pocket. Nowadays, Johnson's 'Dictionary' seems old-fashioned and unscientific. However, it was far better than those which preceded it and paved the way for even better ones. The personal note seems amusing to modern readers. Johnson sometimes permitted his own experience and his own intense feelings to color the definitions he wrote. Some of these follow:

Excise. A hateful tax levied upon commodities, and adjudged not by the common judges of property, but wretches hired by those to whom excise is paid.

Grubstreet. Originally the name of a street in Moorfields in London, much inhabited by writers of small histories, dictionaries, and temporary poems; whence any mean production is called *grubstreet.*

Lexicographer. A writer of dictionaries; a harmless drudge, that busies himself in tracing the original, and detailing the signification of words.

Pension. In England generally understood to mean pay given to a state hireling for treason to his country.

The 'Dictionary' brought him an honorary Doctor of Laws degree from Oxford, well-paying editorial posts, and a government pension. Henry Thrale, a wealthy brewer, and his wife, Hester, became Johnson's best friends. He stayed at their home for weeks at a time and went on trips with them. Fanny Burney, a popular novelist, was also his good friend.

Enter Boswell

In 1763 James Boswell, a young Scottish lawyer of good family, came down to London and met Johnson. At once Boswell conceived a great admiration for the older man. Johnson, then 54, took a liking to Boswell, who was only 22 at the time. They remained good friends until Johnson's death 21 years later, but they were actually together only 276 days during those years. Boswell remembered virtually everything Johnson said while they were together, and each night he recorded their conversations in his journal. In 1773 the two friends traveled through northern Scotland and the islands off the coast.

Johnson died Dec. 13, 1784. In 1791 Boswell's 'Life of Samuel Johnson' was published. It is a curi-

ously uneven work. The first 200 pages cover Johnson's life until he met Boswell. The last 1,100 pages cover the 21 years of their friendship. Despite this lack of balance, it remains one of the greatest biographies ever written—highly readable and entertaining, with acute insights into Johnson's personality.

Aside from his 'Dictionary', Johnson's chief works are: poems—'London' (1738) and 'The Vanity of Human Wishes' (1749); a play—'Irene' (1749); essays—'The Rambler' (1752) and 'The Idler' (1761); a novel—'Rasselas' (1759); a criticism—'Lives of the Poets' (1781).

JOLIET (*zhô-lyĕ'*), **LOUIS** (1645–1700). Working together, Father Jacques Marquette and Louis Joliet discovered and explored the upper Mississippi. They were the first white men to travel the giant river since the Spanish explorer Hernando de Soto had found the lower Mississippi 130 years before.

Louis Joliet (sometimes spelled Jolliet) was born near the town of Quebec, Canada, in September 1645. Intending to become a priest, he studied at the Jesuit seminary in Quebec. He changed his mind before taking final vows, and at 22 he went to France for a year's study in science. Back in Canada, he became a fur trader and made many trail-blazing trips into the western wilderness to barter trade goods for furs with the Indians.

His travels earned him the reputation of being the best-informed man in Canada on the Great Lakes region. He also became an expert map maker and was skilled in Indian languages. Thus in 1672 Count Frontenac, governor of New France, selected Joliet and Father Marquette to find the great river in the west, known then only by rumor (*see* Mississippi River).

They spent the winter at St. Ignace, on the Straits of Mackinac, and started west in the spring. The route of the journey is described in the article on Marquette. On his way back to Quebec, Joliet's canoe was upset and all his maps and papers lost, but Marquette's account of the expedition was preserved. Their notes were of help to La Salle, who explored the Mississippi to its mouth in 1682 (*see* La Salle).

For his work Joliet was granted the feudal rights to several islands in the lower St. Lawrence River, among them the island of Anticosti. There he established his home after his marriage in 1675. Joliet made several more explorations for the government of New France and was later appointed royal cartographer. He died some time in 1700.

JONES, JOHN PAUL (1747–1792). "I do not wish to have command of any ship that does not sail fast, for I intend to go in harm's way." John Paul Jones, America's first naval hero, said that—and meant it. Throughout most of his crowded 45 years of life, Jones kept getting in harm's way, not for the love of a fight but for the love of freedom.

John Paul Jones was born July 6, 1747, on an estate near Kirkcudbright, on the Scottish coast. His father was John Paul, a gardener; the boy was christened John Paul, Jr. He added the "Jones" later. At 12, the boy signed on as apprentice aboard the *Friendship*, a merchantman sailing between England and the American Colonies.

For the next seven years John Paul learned seamanship as a 'foremast sailor. At 19 he was a qualified ship's officer. Meantime he spent his shore leaves in America looking and learning. His elder brother, William, had come to Virginia years before and was now a prosperous planter. From him John Paul saw how a man could rise by his own work in America.

When the youth finished his apprenticeship, he joined the British navy. He did not stay long. At once he saw that no gardener's son, however capable, could rise in the British service. He became first mate on a slaver, but he soon quit the hateful business. Ashore in the West Indies, he became, of all things, an actor. In a season he earned enough to sail home as a passenger. En route, however, the captain and first mate died of typhoid fever. John Paul

JOHN PAUL JONES

This statue of the great naval commander is by G. V. Buck and stands in Washington, D. C. Jones was about five feet six inches tall, slight in stature, but strong and quick.

was the only man aboard who could navigate. He took the ship into port and the grateful owners kept him on as captain.

Misfortune and a New Life

At port in the West Indies Captain Paul had a man flogged for mutinous conduct. The man left the ship, took berth on another, and died some weeks later. Word started that he died as a result of the beating. A court of inquiry cleared Paul, but suspicion hung over him. Later, a drunken sailor attacked Paul in his cabin. Drawing his sword only in defense, Paul accidentally ran the man through. The two accidents troubled Paul, and he fled his ship. In Virginia and North Carolina he found old friends. Calling himself Jones, he led the placid life of a planter.

When the Revolution came he rode to Philadelphia and offered his services. He fitted out and served as first lieutenant on the *Alfred*, the first American man-of-war and the first to fly its national flag (*see* Flags). His first command was the *Providence;* and in 1777 he became captain of the sloop *Ranger*. He flew the newly adopted Stars and Stripes and carried the news of Burgoyne's surrender to France.

From France he sailed to the west coast of England, destroyed coastal shipping, and captured the sloop *Drake*. Back in France, he was given command of the converted merchantman *Bonhomme Richard*, named for Ben Franklin's 'Poor Richard's Almanack', which was very popular in France (*see* Franklin).

Sailing from France he met a convoy off Flamborough Head on England's North Sea coast. The convoy was escorted by the British 44-gun frigate *Serapis*. On the afternoon of Sept. 23, 1779, the *Bonhomme Richard* engaged the *Serapis* in one of the most famous sea battles in history. For hours the ships blazed away at each other at short range. Then Jones maneuvered to lash the bowsprit of the *Serapis* to his own mizzenmast. The *Bonhomme Richard* was badly damaged; and the English captain called upon Jones to surrender. His reply has become classic: "I have just begun to fight!" Victory came quickly when an American sailor tossed a grenade into a temporary powder magazine just below the main deck of the *Serapis*.

Jones's victories at sea brought him high honors from the American and French governments. After the war he served the new nation as agent in Europe and for a brief time he was an admiral in the Russian navy. His health was poor and he retired to Paris, where he died July 18, 1792. In 1905 his remains were brought to America and interred at the United States Naval Academy at Annapolis, Md.

JONSON, BEN (1573?–1637). A notable circle of poets and playwrights met in London's Mermaid Tavern during the reigns of Elizabeth I and James I. Among them was Ben Jonson, who had been a bricklayer as a boy and a soldier in his youth. Back in London after war service in the Netherlands, he became a leading dramatist and poet. He was also an accomplished student of Greek and Latin literature and an outspoken critic of other writers, ready to fight with either pen or sword.

Jonson entered the London theater as actor and playwright just when English drama had risen to its great height under Shakespeare. His first comedy 'Every Man in His Humour' (1598) had Shakespeare in its cast. Jonson fought to hold the drama to the classical standards. When sensationalism swept the stage, he turned from the drama to the masque. He wrote many of these elaborate entertainments for the court of his patron, King James I. James granted him an income, which Charles I afterward increased, and he enjoyed a small salary as chronologer of London. Jonson died Aug. 6, 1637. On his grave in Westminster Abbey is the epitaph: "O rare (supposed by some to be intended for 'Orare', meaning 'pray for') Ben Jonson." (*See also* English Literature.)

Jonson's great tragedies, with their dates of first production, are 'Sejanus' (1603) and 'Catiline' (1611); his best-known comedies, 'Volpone, or the Fox' (1606?), 'Epicoene, or the Silent Woman' (1609), 'The Alchemist' (1610), and 'Bartholomew Fair' (1614). His best-loved song is 'To Celia', which begins, "Drink to me only with thine eyes."

JOSEPH. The story of Joseph is told in the Book of Genesis in the Old Testament. The patriarch Jacob gave Joseph, first-born son of his favorite wife, Rachel, a "coat of many colors." This was a token that Joseph should succeed him as chief of the tribe of Israel. Jealousy flamed in the ten older brothers. At first they wanted to kill Joseph, but later they decided to sell the youth to Ishmaelite traders, who carried him in slavery into Egypt. The brothers dipped the coat in the blood of a kid, and Jacob cried when he saw it: "An evil beast hath devoured him!"

Potiphar, an officer of Egypt's pharaoh, bought Joseph, and made him master of his household. Potiphar's wife, by false charges, caused Joseph to be cast into prison. While there, Joseph interpreted one of the pharaoh's dreams to mean that Egypt faced seven years of plenty and then seven years of famine. The pharaoh made Joseph his prime minister. In the years of plenty Joseph stored up great quantities of grain. In the years of famine Joseph's older brothers and Benjamin, younger than Joseph, went to Egypt to buy grain. The family was dramatically reunited and Joseph eventually installed his father and Jacob's whole tribe in Egypt. Joseph fathered the tribes of Ephraim and Manasseh. (*See also* Jews.)

JOSEPHINE, EMPRESS OF THE FRENCH (1763–1814). On the island of Martinique in the French West Indies stands a statue of a woman. It is that of Josephine Tascher de la Pagerie, a native of Martinique. As the wife of Napoleon Bonaparte, her second husband, she became empress of the French.

She had gone to France in 1779. After her first husband, General Viscount Alexandre de Beauharnais, was killed in the Reign of Terror, she was left with two children. She had prestige in Parisian society, which she kept by use of her wits and charm. Only with reluctance was she induced to marry Bonaparte, then a little-known artillery officer, desperately in love with her. She gave him a social acquaintance

which he had not enjoyed before. Within ten years he had made her Empress of the French, a position for which she was fitted by the charm and graciousness which concealed a very limited education.

Napoleon's love, however, cooled, and in addition she failed to bear him children. In 1809, in spite of her tears and entreaties, she was forced to consent to a divorce. Napoleon wished to secure an heir to his throne and to ally himself with the royal families of Europe, and soon afterwards he married Marie Louise of Austria. The title of Empress of the French was left to Josephine, however, and the Château de la Malmaison near Paris was given to her. There she died in 1814, soon after Napoleon's first abdication.

Her two children by her first marriage were Eugene and Hortense. Eugene proved an able and loyal general under Napoleon and was for a time viceroy of Italy. Hortense married Napoleon's brother, Louis, and became the mother of Napoleon III, president and later emperor.

THE EMPRESS JOSEPHINE

This Pierre Prud'hon painting in the Louvre pictures the young and beautiful Josephine whom Napoleon loved and married, and on whom he bestowed the title, "Empress of the French."

JUGOSLAVIA. Near the close of the first World War, part of the old Austro-Hungarian Empire voted to unite with Serbia and Montenegro. The union was completed by December 1918 and the new nation was proclaimed the Kingdom of the Serbs, Croats, and Slovenes. This name was changed in 1929 to Yugoslavia (also Jugoslavia), which term means South Slavs. (*See* Yugoslavia.)

JULIUS, POPES. The first pope of this name, JULIUS I, SAINT (Pope, 337–352), ruled the affairs of the church in the difficult days of the Arian heresy, when the Eastern emperors were persecuting the bishops who held fast to the creed adopted at Nicaea in 325.

JULIUS II (Pope, 1503–1513) was a member of the della Rovere family, and is remembered equally for his wars to secure and enlarge the papal states, and for his munificent patronage of Raphael, Michelangelo, and other artists of the Renaissance. Under the first head he drove Caesar Borgia out of Italy; and entered into the League of Cambrai (1508) and then the opposing Holy League (1511) with European sovereigns, and even led his armies in person to advance his warlike plans. On the other hand he was a most liberal and energetic patron of art in that time when supreme artists flourished. He tore down the old basilica of St. Peter's to make room for the present one; and for him Raphael and Michelangelo did some of their best work. His successor, Leo X, continued the work of encouraging art and literature.

JULIUS III (Pope, 1550–1555) was less distinguished, but was closely connected with the work of the Council of Trent and sought to aid the Queen of England in restoring that land to the Catholic fold.

JULY. This is the seventh month in the year in our calendar, and the fifth in the Roman calendar, whence it was called *Quintilis* (the fifth). It was later named July in honor of Julius Caesar. It has had thirty-one days from the time of the early Roman calendars. The "July Revolution" is that in France in July 1830, which set aside the Bourbon king, Charles X, and placed his cousin, Louis Philippe on the throne.

JUNE. Three Roman origins have been suggested for the name of this month—in honor of the goddess Juno, the queen of heaven; from the Latin word which means "to join"; and from *juniores*, the young people as opposed to the older ones, to whom some say it was dedicated. Any of these origins seem reasonable enough, for it is the queen of months, since "then if ever come perfect days." It is the month of weddings, and the tides of youth beat fullest and strongest when we are "knee-deep in June." The summer solstice occurs in June (*see* Equinox and Solstice). Before Julius Caesar reformed the calendar June had only 29 days; he added the 30th.

JUNE BUG. If you sit in a lighted room with open windows on a late spring or early summer night, you are almost sure to hear before long the buzzing and bumping of a heavy-flying insect against the ceiling and walls. Presently the visitor will fall to the floor with a thud, and you find a dark-brown beetle about an inch long lying on its back kicking and struggling awkwardly to get on its feet. This is the "June bug" or "May beetle," a member of the scarab beetle family, and a pest.

Although the adult beetles do much damage by eating the leaves of trees and shrubs, it is the larvae or young that are especially harmful. They are white "grubs" as large as the end joint of a man's little finger, with brown heads, that live in the ground for two years or more, and devour the roots of grass and plants. Strawberry beds suffer particularly.

The best way to get rid of the larvae or grubs is to make a weak emulsion of kerosene soap and filter it into the ground. The adults can be killed by using lights to attract them into pans filled with pure kerosene. Scientific name of the genus, *Phyllophaga.*

JUNIPER. Peculiar among the conifers is the juniper, characterized by its berry-like seed cones, which cling tightly to the branches, their gray-blue coloring harmonizing with the dull green of the needle-like foliage. The branches grow irregularly, the branchlets shooting out at all angles. This very ruggedness is charming and causes the juniper to be prized as an ornamental tree, the Japanese especially cultivating these picturesque effects by pruning and training the limbs to fantastic forms.

There are about 40 species widely distributed in the nontropical parts of the Northern Hemisphere. These trees live to a great age; one ancient juniper in the Cache National Forest, in Utah, is estimated to be at least 3,000 years old.

Best known in the United States is the eastern red cedar (*Juniperus virginiana*). The chief remaining stands of this are in the mountains of Tennessee, Arkansas, and Kentucky, though it is found from Canada to the Gulf of Mexico. The widest use has been for pencils, but the scarcity of this lumber now requires the substitution of varieties of juniper not found in North America, and of incense cedar. Red cedar fence posts are in demand because of their resistance to decay, and the largest portion of the annual cut is now used for that purpose. The red aromatic heartwood is used for moth-proof chests. Unfortunately this tree is a host for the cedar-rust fungus, which attacks apple trees.

Most junipers vary in size and shape from tall, columnar forms to low pyramids and platter-like, creeping shrubs used in ornamental plantings. These differences occur especially in the Chinese juniper (*Juniperus chinensis*) and its varieties, native to Eastern Asia. The western juniper (*Juniperus occidentalis*) of the Pacific coast is used for railroad ties. It is an especially rugged tree and grows even in the crevices of the granite ledges of the Sierra Nevada. The common juniper (*Juniperus communis*) is found throughout the Temperate Zone. The berries (cones) of the last are used to flavor gin.

JUNO. The chief Roman goddess was Juno, who was identified with the Greek goddess Hera (*see* Hera). She was the wife of Jupiter and was looked upon especially as the deity of women and of marriage. The calends (first) of each month were sacred to her, and she was worshiped with Jupiter in the great temple of the Capitol as "Juno Regina," queen of heaven. She also had a shrine as "Moneta" (from the Latin *monere*, "to advise"), goddess of admonition or good counsel. From this name the words "money" and "mint" originated, because money was made in a mint attached to this shrine. One of the minor planets between Mars and Jupiter is named for Juno (*see* Asteroids).

JUPITER. In the name Jupiter the first part "Ju-" comes from the same root as the Greek "Zeus," and the last part "-piter" is another form of *pater*, or "father." So Jupiter means "Zeus the father" (*see* Zeus). Jupiter was the chief Roman deity, in a great temple on the Capitoline Hill. The largest of the planets also bears this name (*see* Planets).

JURA (*jū'rȧ*) **MOUNTAINS.** The same geological force which crumpled the earth's crust and formed the magnificent and lofty Alps produced the low uneven Jura Mountains, on the border of France and Switzerland. These mountains cannot boast the grandeur and beauty of the Alps, and the area covered by them is but a small part of that of the Alps. The highest elevation, Crêt de la Neige, is only 5,653 feet, and the average height is no more than 2,600 feet. The Jura Range is about 156 miles long by 38 miles broad, and extends from southwest to northeast from the elbow of the Rhine to the elbow of the Rhone. Except for its central portion the range is cut by many deep, sharp cross-ravines and valleys. The westward side of the mountains descends by gentle slopes to the fertile plains of France, but the eastern side is precipitous, and its foaming streamlets dash down to the rocks to feed the placid waters of Lake Geneva and Lake Neuchâtel.

At the extreme north end of the range is the famous Belfort Gap, a broad pass in the low rolling hills between the Vosges and Jura Mountains. This pass may well be called the "front door of France," for it opens on the most beautiful, fertile, and prosperous section of the country and is the great highway between eastern France and central Europe. In 1870–71 the gap was a key route for German invaders. In the first World War the gap was little used, but during the drive into Germany in 1944 French troops broke through the line at this point.

The peasants pasture their flocks on the grassy uplands of the Jura and some farming is carried on, mostly wheat raising. Mining is of little importance. The mountains are more sparsely wooded than the Black Forest, though the southwest section is famous for its wooden toys manufactured from the boxwood which grows in the mountains. Flourishing little cities have been built on the slopes of the mountains. Watches and spectacles are among the manufactures. The climate throughout is cold and damp in winter, and except in scattered watering places few tourists visit the region.

JURY. In an enclosed space in the courtroom, at the left of the judge, sit the 12 members of the trial jury. They may be both men and women, for many states allow women jurors. They listen to the evidence given by the witnesses, to the arguments of the attorneys, and to the judge's instructions. Then they retire to a room where they are locked in and guarded. The judge may keep them there as long as he has a reasonable hope that they will reach a unanimous agreement. When they have decided on their verdict, they return to the courtroom, and the *foreman* whom they have chosen announces their decision. In civil cases they find "for the plaintiff" or "for the defendant"; in criminal cases their verdict is "guilty" or "not guilty." If they cannot agree, they are dismissed; and a new trial may be held with another jury.

In criminal cases an acquittal is final, and the prisoner may not be tried again on the same charges. If the evidence is clearly insufficient to establish guilt, the judge may direct a verdict of not guilty. After a verdict of guilty, he may grant a new trial if it should appear that legal error was permitted in the conduct of the case.

A trial jury is called a *petty* or *petit jury* (meaning "small jury") because it has only 12 members. In some states, in civil cases and in minor criminal cases there may be fewer than 12 jurors.

A TRIAL IN THE DAYS OF KING ALFRED

This famous picture by C. W. Cope portrays an Anglo-Saxon institution which bore a marked resemblance to the modern grand jury. The twelve senior "Thegns" of a district were appointed to hear the charges against any man accused of a crime and to decide whether the evidence warranted holding him for a test of his guilt or innocence by compurgation or by ordeal.

The work of the *grand jury* comes before that of the petit jury. It is its duty to decide, after hearing in secret the preliminary evidence against a man, whether the state shall accuse him of a crime and hold him for trial. This grand jury, or great jury, usually has 23 members, though the number varies in some states, at times being only 12. Whatever the number on the grand jury, 12 members must agree. If they think from the evidence they have heard that the accused is probably guilty, they *indict* him or "bring in a true bill," and then he is tried by a petit jury. Cases usually come before a grand jury as a result of activity by the police, sheriff, coroner, or state's attorney. But they may start investigations on their own motion or at the suggestion of a judge.

The *panel* (list) of members of a trial jury is selected by lot. Names of citizens eligible for jury service are placed in a locked box and drawn out as needed. When a person's name has been drawn he is summoned to serve by the sheriff. If it is a criminal case he is closely questioned in open court by the opposing lawyers. If he is acceptable to both sides he is passed, but if his answers show that he is prejudiced or has fixed opinions on the guilt or innocence of the accused, or objects to the penalty that may be inflicted, death for instance, he is excluded "for cause" by the judge. Each side may also exclude by "peremptory challenge" an agreed number without stating a cause. Ministers, lawyers, newspaper men, men in the army, navy, and militia, election and government officials are usually exempted from service.

A coroner's jury, usually composed of six men, may be specially summoned by the coroner to decide whether a sudden death was due to murder, suicide, or other causes, and therefore whether or not some person under suspicion of causing the death should be held for further investigation by the grand jury.

In civil cases—that is, in controversies between individuals—juries are widely used to decide questions of fact. The judge applies the law to the facts as the jury finds them to be, and renders judgment. Under certain circumstances the judge can direct a verdict, or if a verdict is manifestly improper, he can set it aside. Usually juries in such cases are not confined during the trial, as they are in important criminal cases.

Of all Anglo-Saxon political institutions, the jury is one of the oldest. The Normans adopted one of the most primitive forms after they conquered England in 1066. But the men who served at these "inquests," as they were called, were chosen not to listen to witnesses, but to decide on the basis of their own knowledge of the facts. This sworn inquest

was used by the king chiefly in transacting the business of the kingdom, but it represented also participation by the freemen in one of the important aspects of government. Not until the reign of Henry II, in the 12th century, were the jurors generally changed from those who knew the facts to men who must decide solely on evidence that they heard in court. A few centuries later the 13 American colonies gave as one of their grievances in the Declaration of Independence that the king had deprived them, in many cases, of trial by jury. When the Americans drew up the Federal Constitution, they provided that in federal courts there should always be a jury in criminal cases, and in civil cases when the amount in dispute was over $20. The state constitutions have generally followed this example.

Early Forms of Trial

In Anglo-Saxon times, when the accused brought into court a number of his neighbors who were willing to swear to his innocence, he was released. In this trial by *compurgation* the number of compurgators needed depended upon the rank of the men who took the oath as well as upon the importance of the case. Then there was the trial by *ordeal*, which was really an appeal to God for a miracle. In the ordeal by fire, the accused plunged his hand into boiling oil or water, or carried a piece of red-hot iron for nine steps, or walked barefoot over glowing plowshares; if the burn healed in three days, he was innocent. In the ordeal by cold water, the accused was bound and thrown into a stream or pond; if he floated, the water had rejected him because he was guilty, but if he sank he was innocent and must be rescued. Finally there was the trial by *combat*, in which a man proved his case by defeating his adversary in battle.

Jury trial introduced evidence and reason in place of superstition, chance, or force. It is also important because it marked a step in the development of the representative system of government, for these early jurors were chosen as representatives of their community, and so are a link in the chain which included the Anglo-Saxon Witenagemot and led up to the British Parliament.

Although the right of trial by jury is one of the corner-stones of English and American legal procedure, trials are being conducted without juries in an increasing number of cases, both civil and criminal. Courts of special jurisdiction, such as small claims courts, domestic relations courts, and juvenile courts, now almost everywhere dispense with a jury. Judges often call on physicians, psychiatrists, and other experts for advice. Cases in equity, bankruptcy, and probate matters are usually decided by the judge, but often with the advice of a *referee* who gives the judge a detailed report of the facts as he found them. In some states the grand jury indictment has been replaced by a form of complaint called an *information*, which is filed by the prosecuting official. Several states do not require a unanimous verdict of the jury in civil, and in less serious criminal, cases.

This modern trend away from trial by jury requires explanation. Critics assert that the jury system is not adapted to the complex structure of modern society. Modern life produces many cases, both civil and criminal, involving countless factors which the layman does not understand. Strangely enough, in court practise, the attorneys on both sides are likely to excuse the more intelligent jurors, and try to retain men who are more likely to be moved by argument and prejudice. On the other hand, the abler citizens are often disposed to dodge jury service because so much of their time is wasted, either in waiting to hear a case or in hearing cases of trivial importance. It takes a long time to select a jury from a panel of citizens (a panel is usually 100 names selected by lot from the list of voters).

To overcome these objections, which some critics assert have destroyed the usefulness of the system, it has been recommended that the veniremen (*venire* being the legal term for a summons to jury service) be investigated before they are called, that fewer professions and trades be exempted, and fewer peremptory challenges be allowed. Defenders of the jury system say that to abolish it would be to destroy one of the few phases of government in which the citizen can take actual part, and would tend to produce a belief that the courts are not conducted for the average man and woman.

JUSTIN'IAN I (483?–565). Most illustrious of all the emperors of the Eastern Roman or Byzantine Empire, Justinian well deserves the title of "the Great," by which he is commonly known. Unlike many of the Eastern emperors, Justinian not only was a strong ruler in his own part of the world, but he exercised a profound influence in the Western World even to our own time. For Justinian was responsible for the codification of Roman law, which is the basis, through the 'Code Napoleon', of the legal systems of most European countries and of one American state, Louisiana. One maxim of Roman law, "All men are created equal," played a great part in the American and French revolutions. The 'Code' of Justinian is a collection of decrees of the emperors; the 'Digest' or 'Pandects', is a summary of 9,000 extracts from the opinions of lawyers and judges who had interpreted these decrees; and the 'Institutes' was a textbook, stating legal principles in simple terms. A fourth book, the 'Novels' (*Novella constitutiones*) includes the ordinances of Justinian after the codification. These four together constitute the Civil Law (*Corpus Juris civilis*).

Statesman and Builder

Justinian dreamed of restoring the Roman Empire to its ancient splendor. His generals, Belisarius and Narses, drove the Ostrogoths out of Italy and the Vandals out of Africa, and temporarily restored those lands to the Empire. He was also a great builder, and throughout his vast empire erected forts, aqueducts, and churches. The most splendid of these buildings is the church of Santa Sophia, one of the

masterpieces of Byzantine architecture (*see* Architecture). Justinian also endeavored to end the disputes between the eastern and western branches of the Christian church. During most of his reign he controlled the elections of the popes and helped to regulate church affairs generally.

This great figure in history came of Slavic peasant parentage, it is believed. He received an excellent education in Constantinople and was adopted by his uncle Justin I, who was emperor from 518 to 527. He succeeded Justin as emperor. Justinian was said to be somewhat cold and ascetic in temperament, simple in manners, abstemious in habits. He loved order and system, hated idleness, and could work long stretches with little sleep.

Much of his success Justinian owed to his brilliant wife Theodora, who had been a popular actress. She had great influence over him both in religious and political matters and wielded vast power. Willful and strong, she demanded obeisance from all who thronged her splendid court and sent out spies to track down those who opposed her. When Justinian would have fled during an insurrection, her firmness kept him on his throne and suppressed the rebellion. (*See also* Byzantine Empire.)

JUTE. The gunny sack that holds your potatoes and sugar was once a mass of silky fibers in the stalks of jute plants growing in a hot, moist field. These plants —whose Indian name is *pat*—thrive best in the double delta of the Ganges and Brahmaputra rivers, for the monsoon rains bring them moisture when they need it most, and the rivers carry them a fresh supply of nourishing soil at each flood time.

Pakistan supplies most of the world's jute, but some grows in China, India, and Thailand (Siam). Throngs of workers sow the pat seed in the spring, weed and thin the growing plants, and harvest them after they have grown tall and borne their yellowish flowers. Then they throw the plants in bundles into pools or creeks to ferment, or *ret*. When the stalks have softened, the skillful laborers wade into the pool and separate the fibers from the stalk. One hundred pounds of pat will yield only about five pounds of the fiber. After being dried in the hot sun, the long fiber goes into great bales to be carried to market in rumbling oxcarts. Some of it goes to other lands for manufacture, but most of it is spun and woven in Calcutta's many mills.

The gunny sack is, perhaps, the most familiar use of jute, but the fiber goes into an increasing list of other products. It is made into rope, cord, and twine. It takes dye readily and is woven into fiber carpets and curtains. Sometimes it is mixed with other fibers to make special kinds of cloths. Jute burlap is made in many grades from coarse bagging and wrapping material to finer wall coverings, upholstering, and linings for clothing. Linoleum has a jute backing (*see* Linoleum). Tarpaulin is often made from jute, as is furniture webbing.

Compared with hemp, manila, sisal, or ramie fibers, jute is inferior in strength, tenacity, and durability. It holds its important place in the manufacturing world because of its low price and adaptability.

Jute belongs to the linden, or basswood, family *Tiliaceae.* Two different species are cultivated, *Corchorus capsularis* and *Corchorus olitorius.*

JUVENILE COURTS. The purpose of juvenile courts is to establish and supervise a plan of control and rehabilitation for youths who have broken the laws of their community. Experience has shown that this can be done best when the court operates without a trial atmosphere. Typically a juvenile court regards a young offender as one who is in trouble because of a situation beyond his control. His court appearance may have resulted from any crime ranging from truancy to murder. Regardless of the crime the entire program is devised to re-establish the young offender as a good citizen.

After the original complaint and arrest the judge and his staff take over. The staff, which frequently includes psychologists, psychiatrists, social workers, and other specially trained workers, investigates the situation and the offender. On the basis of what it finds the judge and the staff establish and carry out a plan of rehabilitation. Such a plan may involve a period of residence in a corrective institution, medical treatment, a foster home for the youth, probation (continued supervision by the court), or any other corrective plan which seems desirable.

Probation is the least expensive means of supervision. It is successful in preventing further court appearances for about 80 per cent of the 375,000 children who appear in the juvenile courts each year. These children range in age from 10 to 18 years, though occasionally a boy or girl younger than 10 or older than 18 is referred to the court. The largest number of children are in the 14- to 16-year age group.

All this special work with children is done on the theory that the average boy or girl wants to be a useful and respected citizen, that no child is born wicked, and that he will usually make good if given a chance. Society now assumes a responsibility for children brought up in improper surroundings. Many experiments along these lines have justified this faith in children (*see* George Junior Republic; Juvenile Organizations).

In 1869 the city of Boston started separate sessions of court for juvenile offenders. The first court entirely for children, however, was established in 1899 in Chicago, by Judge Richard Tuthill. The next year, 1900, Denver opened its juvenile court, under Ben B. Lindsey. He was a pioneer in the movement to have all cases involving children brought before a special court. Judge Lindsey served for 27 years and attained national recognition. He was one of the first to use a woman as assistant judge to deal with girl offenders. The Boston juvenile court was established in 1906. Under Judge Frederick P. Cabot it became one of the best courts in the country. The first woman to serve as a juvenile court judge was Mary M. Bartelme, elected in Chicago in 1927. Juvenile courts now exist in nearly all states.

GROUPS *That Help* YOUNG PEOPLE *Help* THEMSELVES

Members of a New York City Boys' Club put accumulated rain water to good use on the roof of their clubhouse. They are testing a rowboat to be used at the club's summer camp.

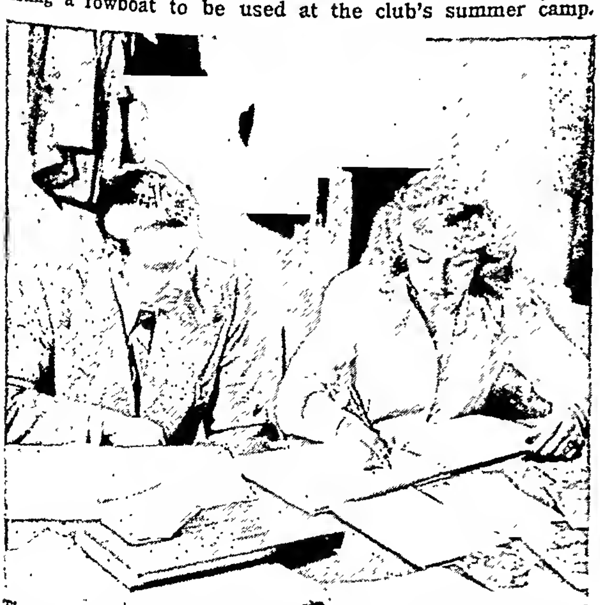
JUVENILE ORGANIZATIONS. Each year hundreds of boys and girls get business experience by forming "companies," selling stock, developing a product, selling it, and working out the amount of their success or failure in dollars and cents. They are a part of the more than 1,500 *Junior Achievement* companies in the United States, an industry-supported program for young people.

Junior Achievement is only one of the many youth groups that help young people help themselves. There are youth organizations to foster and promote almost every organized adult idea—fraternal young people's organizations, junior professional organizations, veterans' organizations, farm clubs, athletic clubs, youth hostels, school, church, and neighborhood clubs, and many more. Together, these are known as *youth-serving organizations.*

In these organizations young people learn how to work and play together through actual experience. They learn not only creative leadership; they also learn, through responsible participation in their various organization activities, the important give-and-take skills that spell good citizenship.

Among the youth-serving groups are many of a general character-building nature that have no direct religious connection. These include the *Boy Scouts of America*, the *Boys' Clubs of America*, the *Girls' Clubs of America*, the *Girl Scouts*, the *Camp Fire Girls*, the *Young Men's Christian Association* (*Y.M.C.A.*), and the *Young Women's Christian Association* (*Y.W.C.A.*). (*See also* **Youth-Serving Organizations** table in the FACT-INDEX.)

There are also many religious organizations for young people run by Protestant denominations, by the Roman Catholic church, and by Jewish groups. These are headed by the *International Council of Religious Education*, the *National Catholic Youth Council*, and the *National Jewish Youth Conference*.



The young president of a Junior Achievement company checks the record books with his treasurer. This company made and sold enough cork coaster sets to pay stockholders a dividend.

Holding mock elections is one of the activities of National Honor Society chapters. These high-school students were in charge of the polls at a Washington, D. C., "national election."

CHURCH AND VETERANS' YOUTH GROUPS PROMOTE GOOD CITIZENSHIP

Church youth conferences are a strong influence for good citizenship. Here city teen-agers attend an open-air chapel class.

This church's summer camp for city boys and girls is located in the rolling hill country of Dutchess County, N. Y.

This "mayor" and his "council" were elected at an Oklahoma "Boys' State" meeting sponsored by the American Legion.

Among the nationally prominent societies for rural boys and girls are the *4-H Clubs*, the *Future Farmers of America*, the *Future Homemakers of America*, and the *New Farmers of America*.

Organizations for high-school students play important roles in serving youth, both to award and to encourage individual and group achievement. The most important of these is the *National Honor Society.* There are other national societies that work within and through the school systems, such as the *American Junior Red Cross.*

There are not many political youth groups in the United States. Labor unions, however, give aid to established youth groups, and industries award youth leaders with cash and scholarships.

Many local groups and clubs have no national affiliation. No matter what their size and affiliation, however, the importance of all youth organizations lies in what they can accomplish at the "grass roots"—the local community level—where young people take part in activities and are influenced by them.

Structure of Youth Groups

Most youth groups have their own elected officers. The majority also have an adult working with them who is called the *adviser*, *club leader*, or *consultant.* Some of the larger organizations keep professionally educated group workers to do this job or have volunteer and part-time people who are supervised by professional group workers.

As far as possible, youth groups are free to make the policies which control the group practices. However, being a part of a larger national or international organization means that there must be certain policies on which all individual groups operate.

Youth groups are encouraged to develop and carry out programs with other groups. Today more and more teen-agers and young adults participate in community planning through welfare councils and their local community chests.

Work of the Youth Councils

Youth councils usually consist of representatives of schools, clubs, church groups, and units of national youth organizations, including young people of various races, religions, classes, and national origins. Such interorganization youth councils co-ordinate activities among the youth organizations in one town or neighborhood and keep adult community-planning groups aware of the major needs of youth.

The Young Adult Council in New York City is made up of the major youth organizations, each of which has representatives and one adult adviser on the council. They work together to help American youth locally, nationally, and internationally.

THE EASY REFERENCE FACT-INDEX

GUIDE TO ALL VOLUMES FOR SUBJECTS BEGINNING WITH

I-J

TO SAVE TIME

USE THIS INDEX ☞

EDITOR'S NOTE ON NEXT PAGE TELLS WHY

SPECIAL LISTS AND TABLES

Numerous other lists and tables in the fields of geography, history, literature, science, mathematics, and other departments of knowledge will be found with their appropriate articles in the main text

EDITOR'S NOTE

EVERY user of Compton's Pictured Encyclopedia should form the habit of *first* turning to the Fact-Index section at the end of each volume when in search of specific information. This index is a miniature work of reference in itself and will often give you directly the facts, dates, or definitions you seek. Even when you want full treatment of a subject, you will usually save time by finding in the index the exact page numbers for the desired material.

All page numbers are preceded by a letter of the alphabet, as A-23. The letter indicates the volume. If two or three page numbers are given for the topic you are seeking, the first indicates the more general and important treatment; the second and third point to additional information on other pages. Where necessary, subheadings follow the entry and tell you by guide words or phrases where the various aspects of the subject are treated.

The arrangement of subheadings is alphabetical, except in major historical entries. In these the chronological order is followed.

The pictures illustrating a specific subject are indicated by the word *picture* or *color picture* followed by a volume indicator and a page number. A picture reference is frequently intended to call attention to details in the text under the illustration as well as to the illustration itself. This picture-text, therefore, should always be carefully read. The pictures are usually on the same page as the text to which you are also referred; sometimes they are found in a different but related article which will add interest and information.

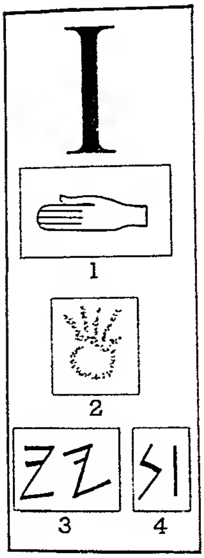
The pronunciations given are those preferred by the best and most recent authorities; alternative pronunciations are indicated where usage is divided.

In recent years hundreds of foreign geographical names have been changed, either officially or by custom. Both old and new names are given at the appropriate places in the alphabet.

Populations are those of the latest census or an official estimate when available if no census has been taken since World War II. Distances between points are map or air distances, not distances by railroad.

THE EASY REFERENCE FACT-INDEX

Reg. U. S. Pat. Off.



Our letter I probably started in Egyptian writing as a picture of a hand with the fingers indicated (1). Soon after 2000 B.C., a Semitic people called the Seirites adopted it as an alphabetic sign for a 'y' sound, because their word *yad* or *yod* for 'hand' began with this sound. For the sign, they made a crude hand (2). The Canaanite-Phoenician alphabet simplified the sign drastically (3); in Hebrew it was called *yod*.

When the Greeks learned to write from the Phoenicians, they did not want a sign for the 'y' sound. They did want a sign, however, for the vowel sound of 'i', which is much like the sound of 'y'. Therefore, the Greeks used the *yod* sign for I and renamed it *iota*.

Another change came when the Greeks reversed the Semitic style of writing from right to left, and turned the *yod* sign around. They also simplified it into a single stroke (4).

The Romans took the *iota* sign into Latin, and from Latin the sign came without change into English. Our small handwritten or printed 'i' is the same as the capital except for a bottom curve which the hand tends to make in writing, and for a dot. The dot was added in medieval times to distinguish the letter from similar ones, such as a hastily written small 'c'.

Note.—For the story of how alphabetic writing began and developed, *see* the articles Alphabet; Writing.

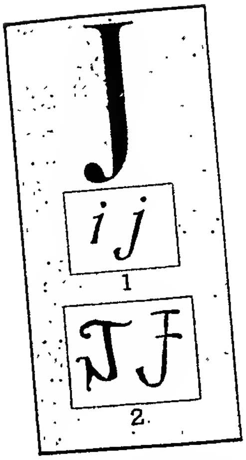
FEDERAL IMPEACHMENTS

Name	Office	Impeached by House	Charge	Tried by Senate	Decision
William Blount	Senator from Tennessee	1797	Treason and sedition	1798-99	Expelled from Senate; case dismissed
John Pickering	District Judge, New Hampshire	1803	Inebriety, profanity on bench	1804	Removed
Samuel Chase	Supreme Court Justice	1804	Political bias in decisions	1805	Acquitted
James H. Peck	District Judge, Missouri	1830	Abuse of official power	1831	Acquitted
West Hughes Humphreys	District Judge, Tennessee	1862	Supporting secession	1862	Removed
Andrew Johnson	President	1868	Violating Tenure of Office Act	1868	Acquitted
William Worth Belknap	Secretary of War	1876	Accepting appointment bribe	1876	Acquitted
Charles Swayne	District Judge, Florida	1904	Misuse of authority	1905	Acquitted
Robert W. Archbald	Judge, U.S. Commerce Court	1912	Misuse of power for own gain	1913	Removed
George W. English	District Judge, Illinois	1926	Misuse of power for own gain	....	Resigned; case dropped
Harold Louderback	District Judge, California	1933	Misuse of power for own gain	1933	Acquitted
Halsted L. Ritter	District Judge, Florida	1936	Accepting fees or gratuities	1936	Removed

WORLD'S LARGEST ISLANDS

	Area in Sq. Mi.
Greenland, est.	735,000 to 1,250,000
New Guinea	300,000
Borneo	290,000
Madagascar	227,700
Baffin	200,000
Sumatra	163,000
Great Britain	88,745
Honshu	86,953
Victoria	80,000
Ellesmere	75,000
Celebes	72,000
New Zealand (South Island)	58,093
Java	48,504

Key: cāpe, ăt, fär, fȧst, whąt, fąll; mē, yĕt, fẽrn, thêre; ıce, bıt; rōw, wŏn, fôr, nŏt, dǫ; cūre, bŭt, rǫde, fǫll, bûrn; out;



UNLIKE most of our letters, J did not come into existence until toward the end of medieval times. Of all the early peoples who contributed to our alphabet, the Egyptians were the only ones who used a 'j' sound and had a sign for it. The other peoples usually used I where we use J. The Roman name 'Julius', for example, was written with an initial I and pronounced *yul-yus*.

During the 9th century after Christ, Latin writers developed the habit, whenever 'i' was doubled (*ii*), of adding a tail to the second one (1). On each letter they used a dot, as explained in the Fact-Index article on the letter I. When printing was invented, the 'tailed i' was used as a capital (2). Thus the *sign* for J came into existence; but it was not used generally for the *sound* 'jay' until the 17th century. At that time the letter also acquired the pronunciation 'dzh' as in 'jug'.

NOTE.—For the story of how alphabetic writing began and developed, *see* the articles Alphabet; Writing.